SCIENCE

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PRINCETON FOR THE NATION'S SERVICE.*

SIX years ago I had the honor of standing in this place to speak of the memories with which Princeton men heartened themselves as they looked back a century and a half to the founding of their college. Today my task is more delicate, more difficult. Standing here in the light of those older days, we must now assess our present purposes and powers and sketch the creed by which we shall be willing to live in the days to come. We are but men of a single generation in the long life of an institution which shall still be young when we are dead, but while we live her life is in us. What we conceive she conceives. In planning for Princeton, moreover, we are planning for the country. The service of institutions of learning is not private, but public. It is plain what the nation needs as its affairs grow more and more complex and

* Address given by Dr. Woodrow Wilson on the occasion of his installation as president of Princeton University.

its interests begin to touch the ends of the earth. It needs efficient and enlightened men. The universities of the country must take part in supplying them.

American universities serve a free nation whose progress, whose power, whose prosperity, whose happiness, whose integrity depend upon individual initiative and the sound sense and equipment of the rank and file. Their history, moreover, has set them apart to a character and service of their own. They are not mere seminaries of scholars. They never can be. Most of them, the greatest of them and the most distinguished, were first of all great colleges before they became universities; and their task is twofold: the production of a great body of informed and thoughtful men and the production of a small body of trained scholars and investigators. It is one of their functions to take large bodies of young men up to the places of outlook whence the world of thought and affairs is to be viewed; it is another of their functions to take some men, a little more mature, a little more studious, men self-selected by aptitude and industry, into the quiet libraries and laboratories where the close contacts of study are learned which yield the world new insight into the processes of nature, of reason, and of the human spirit. These two functions are not to be performed separately, but side by side, and are to be informed with one spirit, the spirit of enlightenment, a spirit of learning which is neither superficial nor pedantic, which values life more than it values the mere acquisitions of the mind.

Universities, we have learned to think, include within their scope, when complete, schools of law, of medicine, of theology, and of those more recondite mechanic arts, such as the use of electricity, upon which the skilled industry of the modern world is built up; and, though in dwelling upon such an association of schools as of the gist of the matter in our definitions of a university, we are relying upon historical accidents rather than upon essential principles for our conceptions, they are accidents which show the happy order and system with which things often come to pass. Though the university may dispense with professional schools, professional schools may not dispense with the university. Professional schools have nowhere their right atmosphere and association except where they are parts of a university and share its spirit and method. They must love learning as well as professional success in order to have their perfect usefulness. This is not the verdict of the universities merely, but of the professional men themselves, spoken out of hard experience of the facts of business. It was but the other day that the Society for the Promotion of Engineering Education endorsed the opinion of their president, Mr. Eddy, that the crying need of the engineering profession was men whose technical knowledge and proficiency rest upon a broad basis of general culture which should make them free of the wider worlds of learning and experience, which should give them largeness of view, judgment, and easy knowledge of men. The modern world nowhere shows a closeted profession shut in to a narrow round of technical functions to which no knowledge of the outside world need ever penetrate. Whatever our calling, our thoughts must often be afield among men of many kinds, amidst interests as various as the phases of modern life. The managing minds of the world, even the efficient working minds of the world, must be equipped for a mastery whose chief characteristic is adaptability, play, an initiative which transcends the bounds of mere technical training. Technical schools whose training is not built up on the foundations of a broad and general discipline cannot impart this. The stuff they work upon must be prepared for

them by processes which produce fiber and elasticity, and their own methods must be shot through with the impulses of the university.

It is this that makes our age and our task so interesting: this complex interdependence and interrelationship of all the processes which prepare the mind for effectual service: this necessity that the merchant and the financier should have traveled minds, the engineer a knowledge of books and men, the lawyer a wide view of affairs, the physician a familiar acquaintance with the abstract data of science, and that the closeted scholar himself should throw his windows open to the four quarters of the world. Every considerable undertaking has come to be based on knowledge, on thoughtfulness, on the masterful handling of men and facts. The university must stand in the midst, where the roads of thought and knowledge interlace and cross, and, building upon some coign of vantage, command them all.

It has happened that throughout two long generations—long because filled with the industrial and social transformation of the world—the thought of studious men has been bent upon devising methods by which special aptitudes could be developed, detailed investigations carried forward, inquiry at once broadened and deepened to meet the scientific needs of the age, knowledge extended and made various and yet exact by the minute and particular researches of men who devoted all the energies of their minds to a single task. And so we have gained much, though we have also lost much that must be recovered. We have gained immensely in knowledge, but we have lost system. We have acquired an admirable, sober passion for accuracy. Our pulses have been quickened, moreover, by discovery. The world of learning has been transformed. No study has stood still. Scholars have won their fame, not by erudition, but by exploration, the conquest of new territory, the addition of infinite detail to the map of knowledge. And so we have gained a splendid proficiency in investigation. We know the right methods of advanced study. We have made exhaustive record of the questions waiting to be answered, the doubts waiting to be resolved, in every domain of inquiry; thousands of problems once unsolved, apparently insoluble, we have reduced to their elements and settled, and their answers have been added to the commonplaces of knowledge. But, meanwhile, what of the preliminary training of specialists, what of the general foundations of knowledge, what of the general equipment of mind, which all men must have who are to serve this busy, this sophisticated generation?

Probably no one is to blame for the neglect of the general into which we have been led by our eager pursuit of the particular. Every age has lain under the reproach of doing but one thing at a time, of having some one signal object for the sake of which other things were slighted or ignored. But the plain fact is, that we have so spread and diversified the scheme of knowledge in our day that it has lost coherence. We have dropped the threads of system in our teaching. And system begins at the beginning. We must find the common term for college and university; and those who have great colleges at the heart of the universities they are trying to develop are under a special compulsion to find it. Learning is not divided. Its kingdom and government are centered, unitary, single. The processes of instruction which fit a large body of young men to serve their generation with powers released and fit for great tasks ought also to serve as the initial processes by which scholars and investigators are made. They ought to be but the first parts of the method by which the crude force of untrained men is reduced to the

expert uses of civilization. There may come a day when general study will be no part of the function of a university, when it shall have been handed over, as some now talk of handing it over, to the secondary schools, after the German fashion; but that day will not be ours, and I, for one, do not wish to see it come. The masters who guide the youngsters who pursue general studies are very useful neighbors for those who prosecute detailed inquiries and devote themselves to special tasks. No investigator can afford to keep his doors shut against the comradeships of the wide world of letters and of thought.

To have a great body of undergraduates crowding our class rooms and setting the pace of our lives must always be a very wholesome thing. These young fellows, who do not mean to make finished scholars of themselves, but who do mean to learn from their elders, now at the outset of their lives, what the thoughts of the world have been and its processes of progress, in order that they may start with light about them, and not doubt or darkness, learning in the brief span of four years what it would else take them half a lifetime to discover by mere contact with men, must teach us the real destiny with which knowledge came into the world. Its mission is enlightenment and edification, and these young gentlemen shall keep us in mind of this.

The age has hurried us, has shouldered us out of the old ways, has bidden us be moving and look to the cares of a practical generation; and we have suffered ourselves to be a little disconcerted. No doubt we were once pedants. It is a happy thing that the days have gone by when the texts we studied loomed bigger to our view than the human spirit that underlay them. But there are some principles of which we must not let go. We must not lose sight of that fine conception of a general training which led our fathers, in the days when men knew how to build great states, to build great colleges also to sustain them. No man who knows the world has ever supposed that a day would come when every young man would seek a college training. The college is not for the majority who carry forward the common labor of the world, nor even for those who work at the skilled handicrafts which multiply the conveniences and the luxuries of the complex modern life. It is for the minority who plan, who conceive, who superintend, who mediate between group and group and must see the wide stage as a whole. Democratic nations must be served in this wise no less than those whose leaders are chosen by birth and privilege! and the college is no less democratic because it is for those who play a special part. I know that there are men of genius who play these parts of captaincy and yet have never been in the classrooms of a college, whose only school has been the world itself. The world is an excellent school for those who have vision and self-discipline enough to use it. It works in this wise, in part, upon us all. Raw lads are made men of by the mere sweep of their lives through the various school of experience. It is this very sweep of life that we wish to bring to the consciousness of young men by the shorter processes of the college. We have seen the adaptation take place; we have seen crude boys made fit in four years to become men of the world.

Every man who plays a leading or conceiving part in any affair must somehow get this schooling of his spirit, this quickening and adaptation of his perceptions. He must either spread the process through his lifetime and get it by an extraordinary gift of insight and upon his own initiative, or else he must get it by the alchemy of mind practiced in college halls. We ought distinctly to set forth in our philosophy of this matter the difference between a man's

preparation for the specific and definite tasks he is to perform in the world and that general enlargement of spirit and release of powers which he shall need if his task is not to crush and belittle him. When we insist that a certain general education shall precede all special training which is not merely mechanic in its scope and purpose, we mean simply that every mind needs for its highest serviceability a certain preliminary orientation, that it may get its bearings and release its perceptions for a wide and catholic view. We must deal in college with the spirits of men, not with their fortunes. Here, in history and philosophy and literature and science, are the experiences of the world summed up. These are but so many names which we give to the records of what men have done and thought and comprehended. If we be not pedants, if we be able to get at the spirit of the matter, we shall extract from them the edification and enlightenment as of those who have gone the long journey of experience with the race.

There are two ways of preparing a young man for his life work. One is to give him the skill and special knowledge which shall make a good tool, an excellent bread-winning tool, of him; and for thousands of young men that way must be followed. It is a good way. It is honorable, it is indispensable. But it is not for the college, and it never can be. The college should seek to make the men whom it receives something more than excellent servants of a trade or skilled practitioners of a profession. It should give them elasticity of faculty and breadth of vision, so that they shall have a surplus of mind to expend, not upon their profession only, for its liberalization and enlargement, but also upon the broader interests which lie about them, in the spheres in which they are to be, not bread-winners merely, but citizens as well, and in their own hearts, where they are to grow to the stature of real nobility. It is this free capital of mind the world most stands in need of—this free capital that awaits investment in undertakings, spiritual as well as material, which advance the race and help all men to a better life.

And are we to do this great thing by the old discipline of Greek, Latin, mathematics and English? The day has gone by when that is possible. The circle of liberal studies is too much enlarged, the area of general learning is too much extended, to make it any longer possible to make these few things stand for all. Science has opened a new world of learning, as great as the old. The influence of science has broadened and transformed old themes of study and created new, and all the boundaries of knowledge are altered. In the days of our grandfathers all learning was literary, was of the book; the phenomena of nature were brought together under the general terms of an encyclopedic natural philosophy. Now the quiet rooms where once a few students sat agaze before a long table at which, with a little apparatus before him, a lecturer discoursed of the laws of matter and of force are replaced by great laboratories, physical, chemical, biological, in which the pupil's own direct observation and experiment take the place of the conning of mere theory and generalization, and men handle the immediate stuff of which nature is made. Museums of natural history, of geology, of paleontology, stretch themselves amidst our lecture rooms, for demonstration of what we say of the life and structure of the globe. The telescope, the spectroscope, not the text-book merely, are our means of teaching the laws and movements of the sky. An age of science has transmuted speculation into knowledge and doubled the dominion of the mind. Heavens and earth swing together in a new universe of knowledge. And so it is impossible that the old discipline should stand

alone, to serve us as an education. With it alone we should get no introduction into the modern world either of thought or of affairs. The mind of the modern student must be carried through a wide range of studies in which science shall have a place not less distinguished than that accorded literature, philosophy or politics.

But we must observe proportion and remember what it is that we seek. We seek in our general education, not universal knowledge, but the opening up of the mind to a catholic appreciation of the best achievements of men and the best processes of thought since days of thought set in. We seek to apprise young men of what has been settled and made sure of, of the thinking that has been carried through and made an end of. We seek to set them securely forward at the point at which the mind of the race has definitively arrived, and save them the trouble of attempting the journey over again, so that they may know from the outset what relation their own thought and effort bear to what the world has already done. We speak of the 'disciplinary' studies through which a boy is put in his school days and during the period of his introduction into the full privileges of college work, having in our thought the mathematics of arithmetic, elementary algebra, and geometry, the Greek and Latin texts and grammars, the elements of English and of French or German; but a better, truer name for them were to be desired. They are indeed disciplinary. The mind takes fiber, facility, strength, adaptability, certainty of touch, from handling them, when the teacher knows his art and their power. But they are disciplinary only because of their definitiveness and their established method: and they take their determinateness from their age and perfection. It is their age and completeness that render them so serviceable and so suitable for the first processes of education. By their means the boy is informed of the bodies of knowledge which are not experimental, but settled, definitive, fundamental. This is the stock upon which time out of mind all the thoughtful world has traded. These have been food of the mind for long generations.

It is in this view of the matter that we get an explanation of the fact that the classical languages of antiquity afford better discipline and are a more indispensable means of culture than any language of our own day except the language, the intimate language, of our own thought, which is for us universal coin of exchange in the intellectual world, and must have its values determined to a nicety before we pay it out. No modern language is definite, classically made up. Modern tongues, moreover, carry the modern babel of voices. The thoughts they utter fluctuate and change; the phrases they speak alter and are dissolved with every change of current in modern thought or impulse. They have, first or last, had the same saturations of thought that our own language has had; they carry the same atmosphere; in traversing their pleasant territory, we see only different phases of our own familiar world, the world of our own experience; and, valuable as it is to have this various view of the world we live in and send our minds upon their travels up and down the modern age, it is not fundamental, it is not an indispensable first process of training. It can be postponed. The classical literatures give us, in tones and with an authentic accent we can nowhere else hear, the thoughts of an age we cannot visit. They contain airs of a time not our own, unlike our own, and yet its foster parent. To these things was the modern thinking world first bred. In them speaks a time naïve, pagan, an early morning day when men looked upon the earth while it was fresh, untrodden by

crowding thought, an age when the mind moved as it were without prepossessions and with an unsophisticated, child-like curiosity, a season apart during which those seats upon the Mediterranean seem the first seats of thoughtful men. We shall not anywhere else get a substitute for it. The modern mind has been built upon that culture and there is no authentic equivalent.

Drill in the mathematics stands in the same category with familiar knowledge of the thought and speech of classical antiquity, because in them also we get the life-long accepted discipline of the race, the processes of pure reasoning which lie at once at the basis of science and at the basis of philosophy, grounded upon observation and physical fact, and yet abstract, and of the very stuff of the essential processes of the mind, a bridge between reason and nature. Here, too, as in the classics, is a definitive body of knowledge and of reason, a discipline which has been made test of through long generations, a method of thought which has in all ages steadied, perfected, enlarged, strengthened and given precision to the powers of the mind. Mathematical drill is an introduction of the boy's mind to the most definitely settled rational experiences of the world.

I shall attempt no proof that English also is of the fundamental group of studies. You will not require me to argue that no man has been made free of the world of thought who does not know the literature, the idiomatic flavor and the masterful use of his own tongue.

But, if we cannot doubt that these great studies are fundamental, neither can we doubt that the circle of fundamental studies has widened in our day and that education, even general education, has been extended to new boundaries. And that chiefly because science has had its credentials accepted as of the true patriciate of learning. It is as necessary that the lad should be inducted into the thinking of the modern time as it is that he should be carefully grounded in the old, accepted thought which has stood test from age to age; and the thought of the modern time is based upon science. It is only a question of choice in a vast field. Special developments of science, the parts which lie in controversy, the parts which are as yet but half built up by experiment and hypothesis, do not constitute the proper subject matter of general education. For that you need, in the field of science as in every other field, the bodies of knowledge which are most definitively determined and which are most fundamental. Undoubtedly the fundamental sciences are physics, chemistry and biology. Physics and chemistry afford a systematic body of knowledge as abundant for instruction, as definitive almost, as mathematics itself; and biology, young as it is, has already supplied us with a scheme of physical life which lifts its study to the place of a distinctive discipline. These great bodies of knowledge claim their place at the foundation of liberal training, not merely for our information, but because they afford us direct introduction into the most essential analytical and rational processes of scientific study, impart penetration, precision, candor, openness of mind, and afford the close contacts of concrete thinking. And there stand alongside of these geology and astronomy, whose part in general culture, aside from their connection with physics, mechanics and chemistry, is to apply to the mind the stimulation which comes from being brought into the presence and in some sort into the comprehension of stupendous, systematized physical fact—from seeing nature in the mass and system of her might and structure. These, too, are essential parts of the wide scheme which the college must plot out. And when we have added to these the manifold discipline

of philosophy, the indispensable instructions of history, and the enlightenments of economic and political study, and to these the modern languages which are the tools of scholarship, we stand confused. How are we to marshal this host of studies within a common plan which shall not put the pupil out of breath?

No doubt we must make choice among them, and suffer the pupil himself to make choice. But the choice that we make must be the chief choice, the choice the pupil makes the subordinate choice. Since he cannot in the time at his disposal go the grand tour of accepted modern knowledge, we, who have studied the geography of learning and who have observed several generations of men attempt the journey, must instruct him how in a brief space he may see most of the world, and he must choose only which one of several tours that we may map out he will take. Else there is no difference between young men and old, between the novice and the man of experience, in fundamental matters of choice. We must supply the synthesis and must see to it that, whatever group of studies the student selects, it shall at least represent the round whole, contain all the elements of modern knowledge, and be itself a complete circle of general subjects. Princeton can never have any uncertainty of view on that point.

And that not only because we conceive it to be our business to give a general, liberalizing, enlightening training to men who do not mean to go on to any special work by which they make men of science or scholars of themselves or skilled practitioners of a learned profession, but also because we would create a right atmosphere for special study. Critics of education have recently given themselves great concern about over-specialization. The only specialists about whom, I think, the thoughtful critic of education need give himself any serious concern are the specialists who have never had any general education in which to give their special studies wide rootage and nourishment. The true American university seems to me to get its best characteristic, its surest guarantee of sane and catholic learning, from the presence at its very heart of a college of liberal arts. Its vital union with the college gives it, it seems to me, the true university atmosphere, a pervading sense of the unity and unbroken circle of learning—not so much because of the presence of a great body of undergraduates in search of general training (because until these youngsters get what they seek they create ideals more by their lack than by their achievement), as because of the presence of a great body of teachers whose life-work it is to find the general outlooks of knowledge and give vision of them every day from quiet rooms which, while they talk, shall seem to command all the prospects of the wide world.

I should dread to see those who guide special study and research altogether excused from undergraduate instruction, should dread to see them withdraw themselves altogether from the broad and general survey of the subjects of which they have sought to make themselves masters. I should equally despair of seeing any student made a truly serviceable specialist who had not turned to his specialty in the spirit of a broad and catholic learning—unless, indeed, he were one of those rare spirits who once and again appear amongst us, whose peculiar, individual privilege it is to have safe vision of but a little segment of truth and yet keep their poise and reason. It is not the education that concentrates that is to be dreaded, but the education that narrows—that is narrow from the first. I should wish to see every student made, not a man of his task, but a man of the world, whatever his world may be. If it be the world of learning, then he should be a

conscious and a broad-minded citizen of it. If it be the world of letters, his thought should run free upon the whole field of it. If it be the world of affairs, he should move amidst affairs like a man of thought. What we seek in education is a full liberation of the faculties, and the man who has not some surplus of thought and energy to expend outside the narrow circle of his own task and interest is a dwarfed, uneducated man. We judge the range and excellence of every man's abilities by their play outside the task by which he earns his livelihood. Does he merely work, or does he also look abroad and plan? Does he, at the least, enlarge the thing he handles? No task, rightly done, is truly private. It is part of the world's work. The subtle and yet universal connections of things are what the truly educated man, be he man of science, man of letters, or statesman, must keep always in his thought, if he would fit his work to the work of the world. His adjustment is as important as his energy.

We mean, so soon as our generous friends have arranged their private finances in such a way as to enable them to release for our use enough money for the purpose, to build a notable graduate college. I say 'build' because it will be not only a body of teachers and students, but also a college of residence, where men shall live together in the close and wholesome comradeships of learning. We shall build it, not apart, but as nearly as may be at the very heart, the geographical heart, of the university; and its comradeships shall be for young men and old, for the novice as well as for the graduate. It will constitute but a single term in the scheme of coordination which is our ideal. The windows of the graduate college must open straight upon the walks and quadrangles and lecture halls of the *studium generale*.

In our attempt to escape the pedantry and narrowness of the old fixed curriculum we have, no doubt, gone so far as to be in danger of losing the old ideals. Our utilitarianism has carried us so far afield that we are in a fair way to forget the real utilities of the mind. No doubt the old, purely literary training made too much of the development of mere taste, mere delicacy of perception, but our modern training makes too little. We pity the young child who, ere its physical life has come to maturity, is put to some task which will dwarf and narrow it into a mere mechanic tool. We know that it needs first its free years in the sunlight and fresh air, its irresponsible youth. And yet we do not hesitate to deny to the young mind its irresponsible years of mere development in the free air of general studies. We have too ignorantly served the spirit of the age —have made no bold and sanguine attempt to instruct and lead it. Its call is for efficiency, but not for narrow, purblind efficiency. Surely no other age ever had tasks which made so shrewdly for the testing of the general powers of the mind. No sort of knowledge, no sort of training of the perceptions and the facility of the mind could come amiss to the modern man of affairs or the modern student. A general awakening of the faculties, and then a close and careful adaptation to some special task, is the program of mere prudence for every man who would succeed.

And there are other things besides mere material success with which we must supply our generation. It must be supplied with men who care more for principles than for money, for the right adjustments of life than for the gross accumulations of profit. The problems that call for sober thoughtfulness and mere devotion are as pressing as those which call for practical efficiency. We are here not merely to release the faculties of men for their own use, but also to quicken their social understanding, instruct

their consciences, and give them the catholic vision of those who know their just relations to their fellow men. Here in America, for every man touched with nobility, for every man touched with the spirit of our institutions, social service is the high law of duty, and every American university must square its standards by that law or lack its national title. It is serving the nation to give men the enlightenments of a general training; it is serving the nation to equip fit men for thorough scientific investigation and for the tasks of exact scholarship, for science and scholarship carry the truth forward from generation to generation and give the certain touch of knowledge to the processes of life. But the whole service demanded is not rendered until something is added to the mere training of the undergraduate and the mere equipment of the investigator, something ideal and of the very spirit of all action. The final synthesis of learning is in philosophy. You shall most clearly judge the spirit of a university if you judge it by the philosophy it teaches; and the philosophy of conduct is what every wise man should wish to derive from his knowledge of the thoughts and the affairs of the generations that have gone before him. We are not put into this world to sit still and know; we are put into it to act.

It is true that in order to learn men must for a little while withdraw from action, must seek some quiet place of remove from the bustle of affairs, where their thoughts may run clear and tranquil, and the heats of business be for the time put off; but that cloistered refuge is no place to dream in. It is a place for the first conspectus of the mind, for a thoughtful poring upon the map of life; and the boundaries which should emerge to the mind's eye are not more the intellectual than the moral boundaries of thought and action. I do not see how any university can afford such an outlook if its teachings be not informed with the spirit of religion, and that the religion of Christ, and with the energy of a positive faith. The argument for efficiency in education can have no permanent validity if the efficiency sought be not moral as well as intellectual. The ages of strong and definite moral impulse have been the ages of achievement; and the moral impulses which have lifted highest have come from Christian peoples—the moving history of our own nation were proof enough of that. Moral efficiency is, in the last analysis, the fundamental argument for liberal culture. A merely literary education, got out of books and old literature, is a poor thing enough if the teacher stick at grammatical and syntactical drill; but if it be indeed an introduction into the thoughtful labors of men of all generations it may be made the prologue to the mind's emancipation: its emancipation from narrowness—from narrowness of sympathy, of perception, of motive, of purpose and of hope. And the deep fountains of Christian teaching are its most refreshing springs.

I have said already, let me say again, that in such a place as this we have charge, not of men's fortunes, but of their spirits. This is not the place in which to teach men their specific tasks—except their tasks be those of scholarship and investigation; it is the place in which to teach them the relations which all tasks bear to the work of the world. Some men there are who are condemned to learn only the technical skill by which they are to live; but these are not the men whose privilege it is to come to a university. University men ought to hold themselves bound to walk the upper roads of usefulness which run along the ridges and command views of the general fields of life. This is why I believe general training, with no particular occupation in view, to be the very heart and essence of university training, and the indispensable founda-

tion of every special development of knowledge or of aptitude that is to lift a man to his profession or a scholar to his function of investigation.

I have studied the history of America; I have seen her grow great in the paths of liberty and of progress by following after great ideals. Every concrete thing that she has done has seemed to rise out of some abstract principle, some vision of the mind. Her greatest victories have been the victories of peace and of humanity. And in days quiet and troubled alike Princeton has stood for the nation's service, to produce men and patriots. Her national tradition began with John Witherspoon, the master, and James Madison, the pupil, and has not been broken until this day. I do not know what the friends of this sound and tested foundation may have in store to build upon it; but whatever they add shall be added in that spirit, and with that conception of duty. There is no better way to build up learning and increase power. A new age is before us, in which, it would seem, we must lead the world. No doubt we shall set it an example unprecedented not only in the magnitude and telling perfection of our industries and arts, but also in the splendid scale and studied detail of our university establishments: the spirit of the age will lift us to every great enterprise. But the ancient spirit of sound learning will also rule us; we shall demonstrate in our lecture rooms again and again, with increasing volume of proof, the old principles that have made us free and great; reading men shall read here the chastened thoughts that have kept us young and shall make us pure; the school of learning shall be the school of memory and of ideal hope; and the men who spring from our loins shall take their lineage from the founders of the republic.

WOODROW WILSON.

THE CARNEGIE INSTITUTION.

THE trustees of the Carnegie Institution obviously have an exceedingly difficult task on their hands. The difficulty is not so much due to the magnitude of the endowment as to the uniqueness of what they have to do. They are launched in very imperfectly charted waters where there are many hidden dangers, and they will have to drive their ship forward much of the time under a slow bell and probably will have to reverse her engines occasionally. But this method of navigating will meet the approval of a great majority of the scientific men of the country, just because they will recognize the conditions under which it is being done and will see it to be the best method.

The trustees would be justified in putting a plank into their policy to the effect that *nothing shall be undertaken, for some years at least, that cannot be easily changed or even given up should the course of events make it best to do so.* In fact I imagine that about this policy is tacitly expected by most scientific men. For example, I suspect my own surprise at the announcement that the institution had acquired the Woods Holl Laboratory and had pledged itself to erect an expensive building and spend $20,000 a year in running it was rather widely shared by those like myself who are keenly interested onlookers.

This remark is not at all intended as a criticism, for although it is difficult to see from the distance of California how the move could have been the wisest that might have been made, yet I do not doubt that, seen from within, there were good and sufficient reasons for making it. My only point is that the announcement surprised me because I had not supposed it would be the policy of the institution, at the outset of its career at any rate, to do that sort of thing.

It may not be unprofitable to consider briefly what in accordance with the policy here suggested the attitude of the trustees might be expected to be in a specific case.

To help along that great class of scientific publication which cannot be carried by publishing houses on a strictly commercial basis would be one of the very important aids that the institution might render science. Supposing it were resolved by the trustees to give a hand here, how shall this be done would of necessity be a foremost question. A number of courses would be found open, all promising well. One would be to build and operate a large publishing house at some central point. This might either establish its own journals and series of monographs for the various departments of learning; or it might act merely as a printing house for reputable journals, etc., now existing, but whose existence is a constant struggle for life.

A second general method would be to grant sums of money, of course under carefully considered conditions, to existing publications, permitting the managers of these to use the money as they best might for broadening the scope and improving the quality and efficiency of the publications for which they are responsible.

Either of these general plans of aid well carried on would work great improvement to the present highly unsatisfactory state of scientific publication in this country. If one of them were to be adopted, which should it be? Were there absolute certainty that either would be best, that of course would answer the question. Certainty, however, would not be possible. On the whole the probabilities would rather favor the first plan, it seems to me. Nevertheless since the second plan would be *almost* as likely to succeed as the first, it would be adopted as it could accord better with the cut-and-try policy. The first plan would involve the permanent investment of a large sum of money in a plant, and this plant, unusual as it would have to be in much of its equipment, could not be readily disposed of should it be found desirable to do this. Furthermore, should series of publications be inaugurated by the institution itself it would be a serious matter to discontinue them. On the other hand, money grants of the sort contemplated in the second plan could be easily modified or discontinued at any time should they be found by the trustees not to be producing satisfactory results. More than this the adoption of the second plan would be favored by the considerations that it would be supplementing and not supplanting experience and well-directed effort 'in the periphery'; and further that it is greatly to the advantage of both libraries and users of libraries that long-established journals should be kept up and improved rather than that new ones should be established.

But the most fundamental difficulty confronting the trustees will be that of so using the funds and influence in their hands as to make them contribute most to the promotion of science, and of accomplishing this without impairing 'activity in the periphery,' to use Professor Münsterberg's happy phrase.

It is easily conceivable that the ranking of our nation among others on the basis of scientific research might be advanced many points, but that this might be accompanied by an actual falling off in such peripheral activity. Promotion at such a cost would, I think, be regarded by most American men of science as having been bought at a price above its worth. Local initiative, wherever found, rewarded solely according to its merit is, after freedom, the most sacred thing to American science as it is to everything else American. Centralization of the sort that produces a weakening of peripheral effort and responsibility is hateful to us; hateful not merely from a na-

tional sentimentalism, but because we know it means the acceptance of one or the other of nature's two alternative penalties for such relief: death or the transformation into a new species. For neither of these are we ready.

But the trustees understand all this. It is not because they need instruction concerning their duties in this regard that so many of the scientific workers voice the conviction here emphasized. Rather it is because we hope it may be assuring to them to have our own declaration that we do not want to be relieved from the efforts we are now constantly making to obtain the means for pushing on our scientific enterprises, but that what we should like would be such a dispensation that our worthy efforts might count for something—might count for as much as they deserve.

Without making the rule a hard and fast one, I should certainly say that aid should be granted on condition that the sum granted be duplicated by those asking it. Professor Branner makes the objection that this condition would usually bar the possibility of getting the needed help since scientific men are rarely in touch with business men of wealth. My reply to this is let us get into touch with such men. It will do both us and them good, whether we succeed in getting their financial assistance or not. I speak from considerable experience here.

For the present I believe the aiding of researches already well planned, frequently far on the way to results, but which are struggling against hope almost for the funds necessary to carry them forward, might advantageously compass the aims of the institution. It is just in the midst of such undertakings that the exceptional man whom Mr. Carnegie is after will be found.

Of course many difficulties beset the way here, such as that of deciding on the merits of the undertakings for which aid is solicited; and of making sure that the money is being used to the very best advantage after it has been granted. But these difficulties are far from insurmountable. The institution might well profit by the experience and methods of the scientific departments of the national government in sending experts to the localities to get information as to the merits of particular schemes by actual inspection and conference.

It may be noted incidentally that a strenuous application of the helping hand policy would almost inevitably carry with it the making more available for investigators the treasures of material and literature at the national capital. It seems, however, as though the government itself might do this. But if it will not, the institution would have to do it to the extent of its ability.

WM. E. RITTER.

UNIVERSITY OF CALIFORNIA,
October 14, 1902.

I HAVE already, in a written communication to its trustees, partially expressed my views upon this subject, having suggested that it be made a center for the systematic collection and classification of scientific literature. In brief that suggestion was that there be organized at once a working force, drawn largely from the needy and worthy post-graduate students of our leading universities (who, while doing this work at Washington, and thereby becoming self-supporting, could also avail themselves of the many opportunities there offered for advanced study both by day and night), and that this particular undertaking should be the preparation of an extended series of scrap books, or rather special binder files, into which could be inserted clippings and excerpts from the various text-books, periodicals, transactions of learned societies, etc., classified as to chemistry both by the individual chemical bodies, and also by some suitable subject-

title scheme; and as to physical and other sciences, both by broad general titles, and by physical data and properties as well.

The plan would mean much clipping from several copies each of such works as the *Berichte*, the journals of the various chemical and physical societies, the *Philosophical Magazine*, etc., and would be a work of great magnitude, requiring for its accomplishment a large force, and it would be a permanent undertaking.

If the Carnegie Institution is to maintain a research laboratory at Washington, the uses of such a collection of specially classified literature would be invaluable and obvious, and even if not, it would seem that one such great reference collection (and it is not likely that there would ever be another) would certainly be well located at such a center of scientific inquiry as the national capital.

To go a step further, however. To what uses could such a collection be put by this institution?

Evidently when once made, it would be invaluable in the preparation of a series of volumes for widespread distribution, along the same lines, but in a much more extended way, of the very excellent compilations on the constants of nature already published by the Smithsonian Institution, with which the name of Professor F. W. Clarke is already associated.

Such subjects as boiling points, melting points, specific gravities, specific heats, electrical constants, thermochemical constants, constants of refraction, coefficients of expansion, etc., would each form separate volumes of a complete and uniform series, and then a series of annual volumes would naturally be issued, bringing them all up to date from year to year; and the preparation and publication of such an invaluable encyclopædia of physical and chemical constants, would be a work well worthy the attention of the Carnegie Institution, and one not at all likely to be accomplished by any other agency; and of its great practical value, scientific as well as industrial, there can be no question whatever.

Moreover, an annual series of volumes on the progress of the year in chemical, physical and other scientific research would also be very acceptable.

All such work would naturally bring out very clearly the numerous determinations of physical and chemical constants, which have either never yet been made, or else have been made in such a manner as not to inspire one with confidence in the accuracy of the published results, and it is along these lines of research that there would seem to be a great need for an extensive and well-equipped research laboratory, located at Washington, and having in hand the determination of chemical and physical constants, wherever the researches of former investigators have passed them by undetermined. One would hardly credit how very incomplete existing data are, unless he has been engaged in some research work and by actual investigation has learned how few comparatively are the known constants, as compared with those still awaiting determinations, and which are only too often so badly wanted.

Naturally this institution would also become a head center, through the good offices of which the work of independent colaborers, at the many laboratories of this and other countries, could be so regulated and planned as to secure cooperation along important lines of research while avoiding unnecessary duplication of work. Such a research laboratory would also naturally take up, from time to time, special lines of original research work, but its regular every-day routine work would be largely on the determination of those chemical and physical constants, particularly of the rarer and very expensive elements and com-

pounds, which are at present so greatly needed but so little known.

The institution would of course always stand ready to afford to competent workers, pursuing special lines of research of general scientific interest, special laboratory facilities, aiding them with grants of expensive material and the loan of costly apparatus in all cases where the circumstances justified it.

This in short is what I think the Carnegie Institution ought to become, viz., a great center for the classification and publication of past and current scientific literature, on a scale never before attempted. A great center of physical and chemical research on the various constants of nature, as well as a place where special chemical, physical and other scientific research on any subject of sufficient importance could be initiated, fostered, and aided, and finally a bureau of publication, where the ultimate results of all these activities could be published and widely distributed, for the general benefit of mankind.

EDWIN A. HILL.

WASHINGTON, D. C.,
October 14, 1902.

TO THE EDITOR OF SCIENCE: As one who has recently been concerned with laboratory research, who has had to encounter the difficulties incident to the publication of a doctorate thesis and who is now professionally interested in educational work, may I be pardoned for expressing my opinion in regard to the application and distribution of the Carnegie fund?

It is a fact that in America the scientific career holds out no such inducements of a social or civic sort as does a similar career abroad, notably in England and Germany, where decorations, titles and various public honors both furnish an incentive and reward within professional circles and bring men of science and the public into closer touch, to the mutual advantage of both. However true it may be that the investigator's work is its own reward, it is probably equally true that the cause of science across the water has profited by the existence of such honors. It has seemed to me that the Carnegie Institution, if devoted to a single purpose, might bring about similar conditions on this side of the Atlantic.

The first thing, therefore, that the announcement of the fund suggested to me, and I doubt not to others, was the establishment of a great institution not only for the purposes of administration but also for the prosecution of research, a Mecca for men of science, a university of universities, controlled by a body of men of acknowledged ability and peopled by graduate students (perhaps solely by men who had already received their doctorate) whose merit had been tested. Appointments for a term of years (for I presume that rotation would be the most desirable policy) to the chairs and instructing staff of such an institution would go far toward a remedy of the existing deficiencies in the incentives for honors in American science. The students might be selected by competitive examination from a list of candidates indorsed by the universities or chosen without actual examination by a tribunal of competent authorities after inspection of their credentials.

I am aware that the idea of a central institution for the prosecution of actual research has been condemned by men whose opinions are far weightier than mine. President Harper, for instance, has said that if the Carnegie fund, instead of encouraging and strengthening the work where it already exists, 'undertakes to establish new foundations, independent of these institutions, in order that its own work may be more tangible, it will prove to be the greatest curse of higher educa-

tion in this country instead of a blessing.' While it may seem overbold to question the conclusions of one who has attained an inside view of the problems of the American university, I cannot but feel that the coming generation, of the scientific investigators at least, would be cheered by the prospect of a great Carnegie institution of research.

If, on the other hand, the fund is to be bestowed upon various objects, there can be no doubt, from the student's point of view, as to what directions the expenditure should take in the main. The assistance of publication is, I believe, one of the definitely marked out avenues for the distribution of the fund. I believe that such assistance should be accorded not only to those who conduct research by the aid of the fund, but also to those who conduct independent investigations. The publication of the doctorate thesis seems unnecessarily difficult. It seems odd, at first thought, that the results of two or three years of research not only do not command any financial return, but are actually, as published, sources of expense to the author. If some journal undertakes to publish the research, the writer has often to pay extra charges of various sorts—excess for proof corrections, excess for tables, excess for fine print, excess for over-length—and the offprints and their distribution add to his indebtedness to the publisher. Even so, I am informed that certain scientific journals are actually conducted at a financial loss, and hence at the personal expense of the editors, unless subsidized by some university. Here, then, are two matters which are not as they should be, and might well concern the Carnegie fund. Could not these difficulties be met in two ways: (1) By the restriction of the number of existing scientific journals, especially by amalgamating the numerous scattered 'studies' of various universities with the leading journals, and (2) by the establishment of a Carnegie Bureau of Printing and Engraving where these standard journals should be printed at an expense no greater than that of the European journals? The cost of publishing could thus be removed from the investigator and assumed by the fund, while the journal, if not then self-supporting, could be aided, possibly, by judicious subsidizing.

I believe, further, that much good would come if these journals, thus amalgamated and thus placed upon a satisfactory financial basis, were supplemented by the publication, for each science, of a 'Carnegie year-book,' giving a full account of the work of the various laboratories (résumés of published articles, description of new apparatus, etc.). This work might profitably, perhaps, include some record of work abroad. Finally, the journals and year-books might be supplemented further by a series of authoritative monographs, published under the auspices of the fund, upon topics within each science. There seems to be a place now for comprehensive historical résumés as complete, even if not at all original, as Helmholtz's 'Handbuch der physiologischen Optik.'

Another obvious avenue of disbursement is the establishment of fellowships and scholarships for graduate students in the universities. If the universities would agree to remit the tuition of all Carnegie fellows and scholars, five hundred and three hundred dollars respectively would give ample provision for the bodily wants of the holders. The scholars might be regarded as presumptive fellows, to be promoted in accordance with the recommendation of their university instructors. Both scholars and fellows might be appointed simply as Carnegie fellows and Carnegie scholars, and allowed to select the university at which they would conduct their studies.

Finally, I believe that there is need of assistance to existing laboratories for the purchase of equipment for new lines of research too extensive to be undertaken by the university, and also for the establishment of small typical laboratories in institutions that can not afford to provide for them. There are few universities that deal so bountifully with every department of research that further material acquisitions are not earnestly desired. Nor is there any reason why, as some have intimated, it should be considered in any sense an indication of incapacity or niggardliness for any university to allow its departmental distributions to be supplemented by donations from the Carnegie fund. The wealthiest university has unsatisfied needs, and Mr. Carnegie's generosity has no flavor of charity.

If I may be allowed to plead for the form of investigation in which I am just now personally interested, I should mention the establishment of psycho-educational laboratories as a subject worthy of the consideration of the administrators of the fund. However great were the differences of opinion which the discussion in 1898 revealed, there was a striking unanimity in the utterances of Professors Titchener, Royce and Münsterberg, all three of whom independently urged the necessity of a linking science between psychology and education. I believe that the plan of establishing psycho-educational laboratories in conjunction with the psychological and educational departments of universities is one of the obvious means for the practical execution of these plans. If, for instance, several such laboratories could divide between them such a question as the methods and values of 'psychometric' tests upon students, a very important problem could be satisfactorily settled. And this is but one of a host of problems.

To summarize, I have advocated (1) that, if practically the whole fund is to be devoted to a single purpose, the establishment of a central institution for the transaction of research would best meet the needs of science in America (especially by supplying some inducement and visible reward for service which would attract men of ability to the profession), (2) that, if the fund is to be, for the most part, divided, its objects should include (*a*) the assistance of publication by the amalgamation of journals, the establishment of a Bureau of Printing and Engraving, the publication of 'year-books' and monographic reviews, (*b*) the establishment of fellowships and scholarships in existing institutions for graduate students, (*c*) the assistance of existing laboratories and the foundation of new laboratories in the universities—a need especially felt in the application to educational theory of the results of the science on which it is in part based.

GUY MONTROSE WHIPPLE.

TO THE EDITOR OF SCIENCE: Scientific research in the past has been made by men who have been workers in college or university laboratories and who have in many cases taught at the same time. This is true of such research the world over. It does not seem to me necessary, in order to promote research, to build new laboratories, to found a special institution or to spend money on a plant. Let present facilities which are open to all and are available in all parts of this country be utilized. There is to-day no lack of laboratory space. If there were it would be far better to increase the size of existing laboratories by moderate appropriations than to create a new one by a large expenditure. Let us have all the money for the direct purpose of aiding research.

Scientific research progresses slowly, each step being a short one, making a little advance from the previous position. It is

the man already at work who sees the opening and makes the step. He is the man to be helped. It is a waste of money to employ new men untried in work. No amount of money will produce scientific discovery. But when the man is known money may help him. Such men are known and are now at work in every laboratory in the country. Some are the heads of the laboratory. These men can employ others to do work of a tiresome necessary kind to help their own work. Others are younger workers with bright ideas which may be worked out under the direction of the head of the laboratory. I believe that every scientist to-day knows of two or more men whom he could select to do good work and who need help. I know two in my department who could do far more than they are doing if I could give each $2,500 a year and thus relieve them of some drudgery of teaching. I would not have them give up teaching. It is the best stimulus to work. Let each head of a laboratory or head of a department in our universities have permission to present the claims of workers known to them, whose quality of work is good, and who need assistance, to the board of managers of the Carnegie fund. Let that board decide the relative value and need of the claims presented and place the money where it will do most good. In this manner research can be aided directly, without any machinery.

The publication of the results of research is much hampered in this country by the expense of illustration. There are plenty of magazines in each department ready to publish work, if the cost can be met. Let the board of managers have the power to make appropriations to individuals to cover the cost of publication, after the particular work in question receives the approval of some recognized authority, *e. g.*, the head of the laboratory where the work is done. No new printing-office is needed. Let present facilities, open to all and ample, but expensive, be utilized.

It seems to me a waste of funds to put up a building for the use of scientific associations. They can hire halls, as they have always done, and thus meet, as they should, in different localities at different times.

Nor do I think the worthy members of such associations need or would accept free tickets to such meetings.

It seems to me, therefore, that the board of managers of the Carnegie fund should apply the fund to aid men now working in science along the regular lines which have hitherto been found practicable, and to utilize facilities which have been found ample in the past.

M. Allen Starr.

I have not given the organization of the Carnegie Institution sufficient thought to warrant me in offering advice as to the best manner in which the fund can be used, and I do not like to go into the discussion of so important a matter with less preparation than would have been necessary if the directors had asked my help; so I am sure you will understand why I do not feel like complying with your request for an article for Science. The results of the steps taken at the start are likely to be so far-reaching, and the possibility of adequate consideration is so untrammeled, that I hardly think that the trustees will commit themselves until they are sure that they have formed a right opinion—except that they may take some isolated step, like the acquisition of the Wood's Hole laboratory, that may subsequently embarrass them as a precedent, without, however, committing them if, in their own judgment, it is not in line with their final policy when this is crystallized.

I have read the proof slips of your

article with a good deal of interest, and I do not at all question your feeling that the discussion of the possibilities of the gift while the organization is yet forming can hardly result in embarrassment, and ought to materially help the trustees. I quite agree with you that there ought to be found a better plan than the permanent shouldering of the burden of a large research establishment, and particularly of one devoted to one department of science if this is to prevent the reaching of a helping hand in other directions, as time brings their needs to light. And I quite agree with you that it would be unfortunate in the long run if the fund, which, though large, is not unlimited, were to be invested in any project which the Government or any of the better equipped existing institutions could undertake, perhaps with the temporary aid that you suggest. To come into the field of any of the Government bureaus that have ample publication funds would, as you well say, result in little if any good, and might actually do harm.

In a nutshell, while I have not given the matter enough thought to warrant the publication of a suggestion even, I have supposed that the opportunity of the Institution lies in the day-to-day and year-to-year use of its funds for the furtherance of the work of any earnest worker in need of aid —whether an individual or an institution. This presupposes the conservation of any sum not needed at any given time, against the day of its real need, with an unusual amount of earnest search for the best place of using it at any given time—for there is no doubt that the most worthy individuals and institutions that could use it are likely to be least forward in applying for aid, either from pride or modesty.*

WM. TRELEASE.

* The above letter was not written for publication, and was received before the current discussion had been begun, but is printed with the consent of the writer.

PRESSURE of official duties makes it impossible for me to write at present an article on the Carnegie Institution. You are, however, at liberty to quote me to the effect that it would be inadvisable for the institution to erect either a geophysical laboratory at Washington or to acquire the Marine Laboratory at Wood's Hole. I think that the policy should be followed of promoting geophysical researches along lines not specifically treated by governmental institutions. Men of parts and ability should be encouraged by grants, under such restrictions as to continuance from year to year as would produce results. Many permanent officials should be discouraged; it is difficult to get rid of a man when he once holds office, no matter if it is evident to every one that his mental powers and physical energy are waning. I do not believe that there should be any large laboratory built by the institution, believing that more effective work and better results could be obtained by subsidizing laboratories now in existence. In short, I hold that the activities of the institution should be kept well in hand under the control of the central commission, so that the rapidly shifting phases of research may receive timely attention through the abandonment of some lines and the taking up of others. This would make the Carnegie Institution in a way the center of the spirit of scientific investigation of the United States.

A. W. GREELY.

SCIENTIFIC BOOKS.

Animal Activities. A First Book in Zoology. By NATHANIEL S. FRENCH, Ph.D. New York, Longmans, Green & Co. 1902. Pp. xxi + 262, with illustrations.

Elementary Zoology. By VERNON L. KELLOGG, M.S. New York, Henry Holt & Co. 1901. Pp. xv + 492, with illustrations.

Nature Study and Life. By Clifton F. Hodge, Ph.D. Boston, Ginn & Co. 1902. Pp. xv + 514, illustrated.

The teaching of the sciences in schools is justified largely by the unequaled possibilities they afford for the development of the powers of observation, but in addition to this primary quality they are by no means lacking in others of great pedagogic importance. Judiciously treated, they may serve also in the training of the powers of deduction and, furthermore, may possess distinct utilitarian advantages not only by imparting information of the kind generally spoken of as 'useful,' but also by awakening in the mind of the child an intelligent interest in nature and a desire to discover nature's laws.

Three elementary text-books of zoology (one of them really pertaining to the wider field of biology) have recently appeared, and it is proposed briefly to consider to what extent each is possessed of the qualities just mentioned. The first of these books is by Dr. Nathaniel French and is entitled 'Animal Activities' (Longmans, Green & Co.). The volume opens with introductory chapters devoted to instructions for the collection and preservation of material for study and to the exposition of some general physiological principles, and then proceeds to an examination of the structure and activities of crickets and grasshoppers, the pupil being guided toward the observations desired by questions. Then follows an interrogational guide to other insects, then to spiders and then to the crayfish and other crustacea, after which the remaining animal groups are considered in succession, beginning with the protozoa.

Subjected to the observational test, the book gives a decided and, on the whole, a satisfactory response, although the criticisms may justly be made that frequently the guiding questions are too leading and that occasionally the pupil is tempted toward decidedly inaccurate observations. But with the deductive and utilitarian tests the reactions are disappointing, contrary to what might be expected from the chosen title. Not that the desired qualities are entirely lacking, but that they are not more equally developed in proportion to the training afforded in observation. A competent teacher who would supply the deficient qualities might use the book with advantage, though it must be confessed that in the treatment of some of the groups it fails to reach the standard which should be demanded in a high school text, which it is intended to be. It is unfortunate that the sources from which some familiar illustrations are borrowed are not acknowledged.

The second book, 'Elementary Zoology' (Henry Holt & Co.), by Professor Vernon L. Kellogg, is of a more thorough character and attains much more perfectly the proper high-school standard. It starts with directions, to a certain extent stated interrogatively, for the study of the toad, the crayfish, the amœba and paramœcium and the hydra, presenting the general principles which may be deduced from each, and then proceeds to the study of each of the great groups of the animal kingdom, beginning with the protozoa. One or more species of each group are selected for study and a clear and interesting account is given of other important members of the group. Then follow brief but generally excellent chapters on natural selection, parasitism, coloration, distribution and similar topics, and finally there are added chapters, again excellent, on the methods for collecting, rearing and preserving material.

The book is throughout deserving of praise. To the observational test it responds most satisfactorily and the author shows an admirable appreciation of the proper perspective in the selection of points to be especially emphasized. It furnishes, perhaps, too many deductions ready made, but this failing is to a large extent compensated by the suggestiveness of much of the descriptive portion of the text and of the chapters treating the more general topics. Especial attention is not drawn to the directly practical side of zoology, although reference is made to many forms of economic importance, but the interesting descriptions of habits and life-histories which occur abundantly throughout the book and the wealth of striking illustrations can hardly fail to arouse in the pupil a deep and lasting interest in 'Nature's children' and to stimulate a

desire for more intimate acquaintance with them.

The third book, 'Nature Study and Life' (Ginn & Co.), by Professor C. F. Hodge, belongs to a different class than the other two, being intended for the teacher rather than for the pupil and for the teacher of younger classes. It may be said at once that it is a book which will be welcomed not only by such teachers, but by all who are called upon to find occupation for the busy little fingers and active, eager minds of children. It is a guide to nature study in its best sense and, as President Stanley Hall properly points out in an introduction, it is entirely free from that effeminization which too often detracts from the usefulness of nature study books.

It presents an abundance of just the kind of material a child should study, the fullest and yet most simple methods for facilitating its observation, admirable suggestions for arousing the reasoning faculties concerning it, a wealth of practical application of the knowledge acquired, and running through the whole there is manifest a love of nature for nature's self which cannot fail to impart itself to both teacher and pupil. To describe in detail the contents of the volume is out of the question, but a citation of the headings of some of the chapters will give some idea of its scope: 'Insects of the Household,' 'Insects of the Garden,' 'Beneficial Insects,' 'Elementary Botany,' 'Home and School Gardens,' 'The Propagation of Plants,' 'Our Common Birds,' 'The Domestication of Wild Birds,' 'Elementary Forestry,' 'Aquaria,' 'Flowerless Plants.' And all these and other topics are treated so clearly and suggestively that he who runs may read and have plenty of food for thought when he sits down to rest. Indeed the book possesses a special charm from the freshness and enthusiasm of the author's style, qualities, which, when combined with fascinating photographic reproductions, make the reader forget that he is reading a book and not listening to the author in person discoursing interestingly and convincingly from the fullness of his knowledge.

The information which the book imparts and the training it aims to give are the information and training which educate. For, as the author rightly says: "To do our duty by our neighbors we need a large body of knowledge of the common things that surround the home," and the acquisition of a knowledge of our duty by our neighbors, using that term in the broader Scriptural sense, and an idea of how best to fulfill that duty is the aim of education. Would that this book were in the hands of every teacher of children and every school trustee throughout the land!

J. P. McM.

Irrigation Farming. By L. M. WILCOX. New York, Orange Judd Co. 1902. Pp. 494, pl. 1, figs. 113.

The first edition of this book appeared in 1895. Since that date irrigation farming has rapidly extended in both arid and humid regions and many improvements have been made in methods, as a result of a better understanding of the principles involved. The author in this revised edition in a measure takes cognizance of these advances by adding a number of new sections and four new chapters, namely, seepage and drainage, electricity and irrigation, irrigation in humid climates, and winter irrigation. It is to be regretted, however, that the revision has not been more thorough and included the correction of the numerous inaccurate, and in some cases absurd, statements regarding certain scientific features of the subject, which are left in this edition just as they were in the original edition. The following, relating to the acids of the soil, is an example:

> In all soils we find two essential acids, known scientifically as humic and ulmic. The first is the acid in the humus, or vegetable and animal matter, in the soil. As animal life is built by vegetable matter, it must eventually turn back to vegetable matter. Ulmic acids are those that exude from the roots of some plants. We should remember that nitrogen is the costliest of all plant foods and the most difficult to retain in the soil, and plants must have it, for it corrects this humic acid in the plant as well as in the soil. The ulmic acids are seldom in sufficient quantity to do harm. But the humic acids when shut off from the proportions of nitrogen or potash—both alkalis—become too concentrated, or the dead microbes

become poisonous to plant life, as the great French chemist Pasteur would have it. Now humic acid has the same effect both in plant life and in the soil—for all nature was torn off the same bolt.

While it must not be inferred that the whole book is on a par with the extract quoted, there is enough of such reckless writing in it, especially regarding scientific matters, to render it almost worthless from a scientific standpoint and to impair seriously its usefulness from a practical point of view. W. H. Beal.

SCIENTIFIC JOURNALS AND ARTICLES.

The *Botanical Gazette* for October contains the following papers: Dr. E. B. Copeland concludes his paper on 'The Rise of the Transpiration Stream.' It is based upon a series of experiments conducted by the writer in the Hull Botanical Laboratory. Water moved upward in an artificial 'tree' of plaster of Paris more than forty feet high, but no definite conclusions could be obtained. The paper, therefore, is rather an historical and critical discussion of the subject. The theories which ascribe the rise of water in trees to either the cohesive power of water or the activity of living cells are thoroughly invalid. There is some sound evidence in support of the view that the pressure of the atmosphere forces the water upward. The water travels a large part of the way in a film between bubbles and the wall of the conducting vessels; but the physical properties of such a film are unknown. Not the least valuable part of the paper is the complete bibliography of the subject containing one hundred and seventy-four titles. Mr. W. J. G. Land publishes an account of the essential morphology of *Thuja*, which throws additional light upon the peculiar morphology of the Coniferæ. No ventral canal cell is organized, but its nucleus appears and is not separated from the egg cell by a cell wall. This nucleus remains in the upper part of the egg and may divide and give rise to several nuclei, the group resembling a proembryo. These results make Arnoldi's conclusions in regard to the absence of ventral canal cells in Cupressineæ very doubtful. In the formation of the proembryo eight free nuclei are formed before cell walls appear. Miss Laetitia M. Snow publishes the results of her studies of the ecology of the Delaware coast in the region of Rehoboth Beach. This paper is designed to fill a gap in our knowledge of the vegetation of the Atlantic coast, connecting the work of Harshberger in New Jersey with that of Kearney in Virginia and North Carolina. There is general agreement with their conclusions, as with the work of Cowles on the Lake Michigan dune flora. Several characteristic northern species reach here their southern limit. The formations and character species are the usual ones of dune regions. Dr. J. M. Greenman describes a new western *Camasia* from Washington.

In *The American Naturalist* for September V. L. Kellogg discusses at some length 'The Development and Homologies of the Mouth Parts of Insects' and Carlo Emery furnishes 'An Analytical Key to the Genera of the Formicidæ, for the Identification of the Workers.' C. E. Preston describes some 'Peculiar Stages of Foliage in the Genus *Acacia*' and C. C. Trowbridge considers the subject of 'The Relation of the Wind to Bird Migration,' the author believing that temperature is a less important factor than is usually believed and that wind is more important.

The Popular Science Monthly for October has as frontispiece a portrait of the late Rudolf Virchow. The first article, by J. W. Toumey, is 'A Study in Plant Adaptation,' with special reference to the cholla, *Opuntia fulgida*. O. F. Cook discusses 'The American Origin of Agriculture,' adducing evidence in support of his theory of a westward migration from America to the Pacific Islands. F. A. Woods continues his study of 'Mental and Moral Heredity in Royalty' and John Waddell discusses 'The (Commercial) Competition of the United States with the United Kingdom.' Arthur E. Bostwick offers a study of 'Scientific Reading in a Public Library'; Alja R. Cook describes 'An Ascent of Mt. Orizaba' and David Starr Jordan reviews the various theories of the 'Origin of the Fins of Fishes,' considering that none of them is yet definitely proved. Calvin M. Woodward has a good discussion of 'Domestic and Inter-

collegiate Athletics' and the final article is a reprint of Virchow's lecture in 1898 on 'Recent Advances in Science, and their Bearing on Medicine and Surgery.' In the November number James R. Angell presents 'Some Reflections upon the Reaction from Coeducation,' the general tone of the article being decidedly favorable to coeducation, and W. D. Halliburton states 'The Present Position of Chemical Physiology,' being one of the Presidential addresses before the British Association. 'Scientific Palmistry' by Harris H. Wilder is a plea for the use of impressions of the palms and soles for the purposes of identification. 'Towards the North Pole,' reprinted from the London Times shows the work that has been done, but impresses one with the high latitudes reached by the early navigators in their small vessels. Waldon Fawcett describes 'The Development of Economical Utilities for Handling Raw Material' and Frederick A. Woods presents the fourth of his studies of 'Mental and Moral Heredity in Royalty,' while David Starr Jordan tells 'How to Collect Fishes,' an art with which he has had long acquaintance.

Bird Lore for September–October contains 'The Destructive Effects of a Hailstorm Upon Bird Life' by H. McI. Morton, 'A Goldfinch Idyl' by Ella Gilbert Ives, the three best lists of birds observed by members of the Massachusetts Audubon Society and the sixth instalment of 'How to name the Birds' by Frank M. Chapman, besides Notes, Reviews and reports of the Audubon Societies. From this last it appears that there is to be a revival in the use of birds in millinery and that renewed efforts must be made by friends of the birds.

The Museums Journal of Great Britain contains a description of the Oceanographic Museum of the Prince of Monaco, reviews of various museum reports and a large number of notes on museums at home and abroad. It also contains the first instalment of a 'Directory of the Museums of Great Britain and Ireland,' which is intended to give a very considerable amount of information concerning each institution.

IN *The American Naturalist* for October Bashford Dean considers the 'Historical Evidence as to the Origin of the Paired Limbs of Vertebrates,' concluding that this supports the view that they are derived from a continuous lateral fold. D. H. Campbell gives a summary of 'Recent Investigations upon the Embryo Sac of Angiosperms' and Leonard W. Williams describes 'The Vascular System of the Common Squid, *Loligo Pealii*.' F. M. Webster shows the importance of 'Winds and Storms as Agents in the Diffusion of Insects'; D. S. Jordan tells of 'The Colors of Fishes,' not only the permanent colors, but those temporarily assumed, and T. D. A. Cockerell gives some notes on 'Flowers and Insects in New Mexico.' This paper is likely to prove a stumbling block to bibliographers for it contains descriptions of several new species of bees, although there is no hint of this either in the title or introduction.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 358th meeting of the society was held Saturday evening, October 28.

Mr. W. H. Dall stated that in examining some Corbiculas from Uruguay it was found in several species that the females contained a large number of young shells of various ages; some were developed so far as to show traces of the radiating color markings which characterize the adult. The palearctic Corbiculas have been abundantly collected and described, but no record of their incubation of the young in the maternal body appears in the manuals or such works on the Corbiculidæ as he had been able to consult. It is probable, therefore, that they do not retain the young in this manner. If this inference be correct, the separation by Fischer, on conchological characters, of the South American species under the name of *Neocorbicula* would receive additional support from the difference indicated.

A similar discovery was also announced by Mr. Dall in the common boreal shell known as *Cardita* (*Venericardia*) *borealis*, Conrad,

females of which were found crowded with young shells in a marsupium similar to that of *Sphærium,* not resembling that of *Thecalia,* and other Carditidæ in the ventral portion of the mantle, but in the dorsal region of the body. Specimens from the Aleutian Islands were in this condition about June 1, while in the Polar Sea, near Point Barrow, it occurs in August.

Dr. R. E. B. McKenney spoke on 'Luminous Bacteria.' He briefly reviewed the work done on the luminous bacteria during the past quarter of a century and recorded some of his own observations. In all cases the temperature limits for light production are within those for growth. As soon as the temperature passes beyond limits for normal light production, light instantly disappears. *Bacillus phosphorescens,* Fischer, when grown for a number of generations at 35° C., which is 5° above the maximum temperature for light production, develops a race which emits light at this temperature. Ether to the amount of .1 per cent. in the culture media at once destroys light emission, but not the life nor growth of the bacteria. If the bacteria are grown for a number of generations subject to the effect of .1 per cent. ether in culture, they develop a race which gives forth a light fully as bright if not more brilliant than normally occurs.

The nutrition of these bacteria is of exceptional interest. It was found that a considerable amount of either a *sodium* salt or a *magnesium* salt was essential to growth and to light emission. The amount required for light production was greater than that required for life. Sodium and magnesium are best utilized in the form of their chlorides or nitrates. Other salts of these elements can be utilized, but not to the same advantage as those mentioned. Salts of the other alkali and alkaline-earth metals cannot replace sodium.

Dr. McKenney's conclusion was that the light production was an intracellular phenomenon. He held, however, that this did not necessarily mean that light production was inseparably bound up with life and incapable of explanation on a physico-chemical basis. The observations of Rodziszewski were cited as evidence of a possible physico-chemical explanation.

Mr. Frederick V. Coville spoke on the 'Plants of the Klamath Indians.' He stated that the country inhabited by these Indians was situated where the wooded western region extended upward and into the plains country east of the Sierras, and that favorable surroundings had made this tribe decidedly superior to their neighbors. The speaker dwelt at some length on the Indian names for the plants, stating that the origin of many was obscure, as they were not derived from roots of other words, but were used only for this class of names. Mr. Coville then described some of the plants most extensively used and stated that the Indians distinguished the plants by their properties rather than by botanical characters. Thus they recognized the differences between two very similar species of *Cornus,* while they had but two names for several species of willows.

F. A. Lucas.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 555th regular meeting was held October 11, 1902, President Rathbun in the chair.

Mr. J. F. Hayford gave a brief account of recent gravity experiments at the North Tamarack Mine, Michigan, in which he had assisted, and spoke of the anomalous plumb-line divergences and the failure of steel balls dropped down the 4,600-foot shaft to reach the bottom.

The first regular paper was by Professor F. W. Clarke on 'A New Law in Thermochemistry.'

This paper is an extension of one which was presented at the Pittsburgh meeting of the American Association for the Advancement of Science, and of which an abstract appeared in Science for August 22. The general conclusions are as follows:

1. The *absolute* heat of formation of any chemical compound is a function of the number of atomic linkings or unions in the molecule.

2. In the group of substances represented by the aliphatic hydrocarbons, their halides, sulphides, amines and ethers, the absolute heat

of formation is directly proportional to the number of atomic unions in the molecule.

3. The absolute heat of formation of any organic compound is a multiple, by a whole number, of a single constant. The latter is identical with the neutralization constant, and has a value somewhere between 13,700 and 13,800 calories.

4. The thermal value of a union between two atoms is independent of their masses.

5. The absolute heats of formation of corresponding chlorides, bromides and iodides are equal.

The last conclusion at once suggests a correlation between thermochemical data and Faraday's law. From this point of view, the latter may become part of a wider generalization whose details are yet to be worked out.

Mr. J. D. Thompson then explained the principles of the 'Reclassification of the Science Section at the Library of Congress.' All the books in the library are to be grouped in twenty-six classes, lettered A to Z; Q is assigned to science; a second letter gives the first subdivision, and then follow numbers, as Q A 503; in a second line the familiar Cutter author-abbreviations are given. The division is to be rather minute since access to the shelves will be liberally granted to students. It is expected that ultimately the library will have a card catalogue of all the other Washington libraries.

C. K. WEAD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

GUESSES ON THE RELATIVE WEIGHTS OF BILLS AND COINS.

IN SCIENCE for April 25 an account was given by Mr. J. Franklin Messenger of certain results obtained in reply to the question, 'How many one-dollar bills will equal in weight a five-dollar gold piece?' The answers revealed a quite startling notion either of the heaviness of the coin or of the lightness of the bill, the average guess being 2,291 for 97 students of Columbia University and 2,749 for a class of students in the University of Kansas. The correct answer should have been about 7. The writer of the article used only those results that were obtained from male students, somewhat disparagingly remarking that he had omitted the replies of the women because of their great variation. Since the feminine power to make reliable, or at least utilizable, estimates of this nature was thus called in question, I determined to put the same query to a class of 175 students in Smith College. The results were by comparison so gratifying that it may be of interest to state them.

A few had heard of the question before and were more or less sure of the correct answer. Their replies were, of course, excluded, leaving 162 replies for consideration. The average estimate was 108, as compared with the above given figures, 2,291 and 2,749. But, as Mr. Messenger rightly says, it is not so much the average as the median that is here significant. This was found to be 25, as compared with 45 for the Columbia students and 99 for the students of the University of Kansas.

Since a five-dollar gold piece is a relatively unknown quantity to those of us who live in this part of the country, a further question was asked as to the number of one-dollar bills requisite to equal in weight a fifty-cent piece. The average of 162 replies was 161.7, the median 50. The correct number is between 9 and 10. Familiarity with the coin seems not to have added materially to the correctness of the estimate.

I am not at all sure that such investigations as this disclose any profound psychological laws, but the results here given may serve to correct the error that women are less capable than men to make estimates of this sort.

A. H. PIERCE.

SMITH COLLEGE.

A POINT IN NOMENCLATURE.

MORE than once lately, lacking time to explain my views on zoological nomenclature in detail, I have stated to correspondents that they agreed with those of Dr. D. S. Jordan, supposing the latter to be well known. I am, therefore, somewhat distressed to find Dr. Jordan and Mr. Fowler (*Proc. U. S. Natl. Mus.*, XXV., pp. 266–268) adopting a course in nomenclature which seems to me inadvis-

able. As the case is similar to others which have to be decided one way or the other, it is worth while to discuss it briefly.

Schlegel in 1846 described a fish from Japan as *Monacanthus oblongus*. It turned out, however, that his description really covered two entirely different fishes. The description of the adult related to a *Pseudomonacanthus*, that of the supposed young, and also the figure, to a *Stephanolepis*. Now, I should say that in such a case the description purporting to relate to the adult fish should go with the name, although as a matter of fact the alleged young may also have been adult. This would be because (1) the author's conception of the species would surely be primarily based on the adult, and (2) the description of the adult presumably would in all such cases have priority of place over that of the supposed young or of the plate figuring the latter.

Supposing, however, that these contentions are not held valid, I would then say that the first name given to one of the two species should hold, the residue (*i. e.*, the other species) carrying the original name. Now it happens that the first new name given was *Monacanthus Broeki*, Bleeker, 1857.* This name pertains to Schlegel's supposed young, so on both counts the name given by Schlegel belongs to the fish described as adult. Nevertheless, Dr. Jordan and Mr. Fowler, following Dr. Günther, give the Schlegelian name to the fish described as the young, and call the other by Günther's name, *modestus*, proposed as late as 1877. According to my view, the fishes should be:

1. *Stephanolepis Broeki* = *Monacanthus Broeki*, Bleeker.

2. *Pseudomonacanthus oblongus* = *Monacanthus oblongus*, Schlegel (part); = *M. modestus*, Günther.

It is also to be remarked that the name *oblongus* is more suggestive of the latter than of the former fish, judging from the figures.

T. D. A. Cockerell.

East Las Vegas,
New Mexico.

* According to Jordan and Fowler, *M. frenatus*, Peters, 1855, is possibly applicable; if so, it is an earlier name for the same fish.

COMPARATIVE STRENGTH OF ANIMALS.

To the Editor of Science: In the letter entitled 'The Strength of Ants,' in your issue of September 26, it was observed that an ant weighed 3.2 mg. and a grasshopper which it was dragging weighed 190 mg. If one desires to magnify the ant and calculate the corresponding strength which might be expected, it appears that if the animal be doubled in lineal dimensions its weight will be multiplied by the cube of two or 8, while its strength, which is doubtless determined by the cross-section of its muscles, will be multiplied by the square of two or 4. Now suppose that this small animal is multiplied in size 300 times in length and correspondingly in breadth and height, so that its weight will approximate to 3.2 mg. multiplied by 300 cubed = 86.4 kg. Whereas if its strength is represented by a weight of 190 mg., this multiplied by 300 squared = 17.4 kg. These figures will correspond to a man weighing 190 pounds dragging 38.5 pounds, a proportional strength with which we are very familiar.

F. P. Dunnington.

University of Virginia,
October 20, 1902.

A BIOGRAPHICAL INDEX OF THE MEN OF SCIENCE OF THE UNITED STATES.

At the request of the executive committee of the Carnegie Institution I am compiling a biographical index of the men of science of the United States. It is intended in the first instance for the use of the institution, but it will probably also be published. The index should include all those who have carried on research in science, the term, however, being used in its narrower sense so as not to include on the one hand philology, history, economics, etc., nor on the other hand medicine, engineering, education, etc., except in so far as these applied sciences may contribute to pure science.

During the summer I sent to a large list of names (some 8000) a blank with the request that it be filled in and returned. The blank asked more especially for information in regard to the scientific career and work of those to whom it was addressed. The re-

sponse has been very gratifying, but as the circular was sent with a one cent stamp, it did not reach immediately some of those absent from home during the summer holidays. I shall be glad if those who have received this blank will fill it in and return it to me. It will be necessary to send a second request by letter postage to those who have not replied; but time and money will be saved if those who see this note will be so kind as to fill in and return the blank in case they have not already done so.

The list of those to whom the blank was sent was compiled with care, and includes the members of the scientific societies of the United States requiring research as a qualification (some fifty), the scientific staffs of the leading institutions of learning (some seventy), the scientific men included in 'Who's Who in America' and others whose names were accessible. There are, however, many connected with smaller institutions and in private life, not members of scientific societies, who have published research work of value, and I shall be glad to have assistance in securing their names and addresses. I shall be under obligations to any readers of this journal who have carried on research in the sciences, but who have not received the blank, if they will send me their names; and I shall be glad to receive the names and addresses of any who have carried on research, but whose names would not be discovered from the lists of societies, larger institutions of learning and existing biographical dictionaries.

J. MCKEEN CATTELL.

GARRISON-ON-HUDSON, N. Y.

SHORTER ARTICLES.

THE PARASITISM OF CEPHALOTHECIUM ROSEUM.

IN discussions of the numerous fungi that are known to cause the rotting of apples and other fruits *Cephalothecium roseum*, Corda, has had but brief mention. It is generally regarded as a saprophyte, and Clinton* reports it as such on badly rotted apples. However, Aderhold* observed a case in which it caused a rotting of pears by growing through *Fusicladium pirinum* spots. But it has never been classed as a rot fungus of any economic importance.

In New York State during the past season it has proved to be a true parasite and the cause of an apple rot of great economic importance. In some sections of the State thousands of barrels of apples have been ruined by it. Apple scab, *Fusicladium dendriticum*, has been unusually common this year. In September and October it was noticed that on many of the scab spots there appeared a white or pinkish growth which transformed them into brown, sunken, bitter, rotten spots. Upon investigation it was found that this white growth was *Cephalothecium roseum*, Cda., and inoculations made upon many different varieties of apples and pears under antiseptic conditions, with pure cultures, have proved that it is parasitic, and the cause of the rot. In every inoculation the characteristic rot developed while the same number of check fruits remained sound.

The common occurrence of this fungus upon the *Fusicladium* spots while it is wholly absent from other portions of the fruit is due to the fact that *Fusicladium* ruptures the epidermis and thus furnishes a means of entrance for the *Cephalothecium*, which could not otherwise attack the fruit, since it appears to be incapable of penetrating the unbroken epidermis.

It is often found on apples while still on the trees; but after they have been harvested and left in piles on the ground or barreled and allowed to remain where the sweating process can take place, it has become so abundant on certain varieties as to ruin the fruit for storage.

Further investigations are in progress; and when completed they will be published in a

* Clinton, G. P., 'Apple Rots in Illinois,' Ill. Agr. Exp. Station Bul. 69: 193. F. 1902.

* Aderhold, Rud., 'Arbeiten der botanischen Abteilung der Versuchsstation des Kgl. pomologischen Instituts zu Proskau,' *Centralbl. f. Bakt. Parasitenk. u. Infektionskr.*, II. Abt., 5: 522. 1899.

bulletin of the New York Agricultural Experiment Station.

H. J. Eustace.

Geneva, N. Y.,
October 24, 1902.

CURRENT NOTES ON PHYSIOGRAPHY.

THE MISSISSIPPI IN SOUTHEASTERN MISSOURI.

There is a narrow belt of lowland in southeastern Missouri that is separated from the broad lowland flood plain of the Mississippi by a low upland known as Crowley ridge. Marbut gives an interesting explanation of these features ('The Evolution of the Northern Part of the Lowlands of Southeastern Missouri,' Univ. of Missouri Studies, I., 1902, No. 3, viii + 63 p., 5 pl., 2 maps). The two lowlands have been eroded by the Mississippi and the Ohio rivers, whose confluence originally lay south of Crowley ridge. A series of changes, well worked out by the author, resulted in two successive captures of the Mississippi, whose flood plain was at a higher level, by the Ohio, whose flood plain was at a lower level. The first capture was at the head of Crowley ridge; and here the river ran long enough to open a flood plain thirty miles wide. The second capture was fifteen miles farther northeast, at the head of a smaller upland called Benton ridge, where the new twenty-mile course of the great river has been so lately assumed that it is still a narrow gorge without bordering flood plain. Crowley and Benton ridges are, therefore, in a certain sense examples of that peculiar class of hills which results from the isolation of the terminal part of a ridge between two rivers when a new point of confluence is developed, upstream from the former point; the notable feature of this case being the unusual length of the first (Crowley) isolated portion of the ridge. This origin of the ridge had been suggested in general terms by earlier writers; but to Marbut belongs the credit of demonstrating the changes involved and of explaining closely the processes by which they were brought about.

LAKES IN THE GLARNER ALPS.

The origin of the small lakes in the higher valleys of the Glarner Alps, southeast of Zurich, is discussed in a doctorate thesis of the University of Basel by S. Blumer ('Zur Entstehung der Glarnerischen Alpenseen,' *Eclog. geol. helvet.*, VII., 1902, 203–244, 4 pl.). He concludes that the lake basins are all closely associated with the former glaciation of their valleys. Most of the basins are described as relatively insignificant depressions due to glacial erosion in an old valley floor; but some of them are enclosed, in part at least, by torrential fans, and others are associated with underground discharge in limestones.

This essay shares with many others a plan of treatment that seems, in view of recent studies of glacial erosion, to give a too limited consideration to the problem in hand. It is tacitly implied that the rock barriers next below the basins have not suffered any significant amount of erosion; and hence that practically the whole measure of glacial erosion is seen in the depth of the basins above the barriers. Many recent studies indicate, on the other hand, that both basins and barriers in glaciated valley floors have suffered severe erosion, and that the excess of erosion in the basin over that on the barrier is a relatively small fraction of the total erosion by which the valley trough—the glacial channel—as a whole was deepened. The origin of lake basins in glaciated districts therefore calls for a general study of the entire valley in whose floor the lake occupies only a 'relatively insignificant depression'; just as the origin of a pool in a dry river bed involves the explanation of the whole river channel, and not merely of the pool alone. It may also be noted that the torrential fans by which so many of the Swiss valleys are obstructed, in some cases to the point of barring lakes, are best explained as indirect consequences of glacial erosion; the stream in the over-deepened main valley being unable to sweep away the abundant detritus washed in by the over-steepened side streams that leap down from their hanging valleys. In a word, the study of Alpine lakes demands a more general treatment than it is given in Blumer's essay.

THE LAKES OF WALES.

The deficiency just pointed out is largely remedied in 'A Bathymetrical and Geological

Study of the Lakes of Snowdonia and Eastern Carnarvonshire' by T. J. Jehu (*Trans. Roy. Soc. Edinb.*, XL., pt. 2, 1902, 419–467, 8 pl.). Twenty-six pages are given to an account of the lake basins, illustrated by contoured maps and true-scale sections. The lakes are of two kinds: the larger ones lying in the main valleys, the smaller occupying cirques (cwms). After discussing the origin of the lakes, it is concluded that they are relatively subordinate results of the glacial erosion by which the valleys of the Welsh mountains have been strongly scoured. As seems to be generally the case in such regions, the main valleys are preglacial, but now 'the more important valleys are at places over-deepened as compared with the lateral valleys and * * * have a trough-like form with flat bottom and steep cliff-like walls.' Tributary streams often cascade into the main valleys. Cirques, with or without lakes, occur at the valley heads. "If the glaciers have thus * * * eroded the channels along which they flowed, the excavation of rock basins below the general level of the valley floor * * * need no longer excite surprise or be looked upon as anything more than subordinate incidents in the general history of ice erosion."

It is suggested that 'the lakes occupy in their respective valleys just those positions in which the glaciers might be expected to have carried on most actively the work of erosion,' and these positions are said to be next above narrows, presumably due to harder rocks, where the glacier would be retarded in its flow; but this last point seems open to question. The erosion of a lake basin in a valley floor just above a hard-rock narrows would not be inconsistent with a maximum erosion further up the valley where the glacier was thicker, for erosion might depend on the maximum pressure of the ice, rather than on its retardation. The height of hanging lateral valleys should be considered along with the depth of lake basins in determining the places of greatest glacial erosion in main valleys.

W. M. DAVIS.

RECENT ZOOPALEONTOLOGY.

TRIASSIC ICHTHYOSAURS FROM CALIFORNIA AND NEVADA.

ICHTHYOSAURS are so rare in America and Triassic ichthyosaurs are so rare everywhere, that these discoveries in Nevada and in Shasta County, California, are particularly welcome. Professor John C. Merriam* describes very fully the *Shastasaurus* of the Upper Triassic of California from considerable portions of seven individuals, together with many isolated bones and teeth representing nearly the whole of the skeleton, but lacking the very important distal portions of the paddles. These remains are placed in six species. From the Middle Triassic of Nevada, the *Cymbospondylus* of Leidy, including three species, is more fully defined and characterized.

RELATION OF THE OSTRACODERM AND ARTHRODIRAN FISHES.

DR. OTTO JAEKEL contributes a new discussion† of this group decidedly at variance with the views of Smith Woodward and Dean. He unites the Arthrodira and Ostracodermata, which have been separated by Cope, Smith, Woodward and Dean, into the single order of Placoderms. Among the Ostracoderms he believes that the Pteraspids have retained a larval character, whereas the Asterolepids have become somewhat more specialized. The Coccosteid arthrodires including *Coccosteus, Dinichthys* and *Titanichthys,* have attained a higher organization, and, owing to their freer motions, have a completely segmented skeleton provided with limbs, which enables us to compare them with other vertebrates. He gives a partial restoration of *Coccosteus,* the chief feature of which is the prominent pelvic girdle, the existence of which has been questioned by Dean. The Coccosteids exhibit parallels with the ancient types of sharks and crossop-

* 'Triassic Ichthyopterygia from California and Nevada,' University of California Publications, Bulletin of the Department of Geology, Vol. 3, No. 4, pp. 63–108, pls. 5–18.

† 'Coccosteus und die Beurtheilung der Placodermen,' *Gesells. naturf. Freunde zu Berlin,* 20 Mai, 1902.

terygians, with the Chimæroid fishes, and even with the tetrapod Stegocephalia. He concludes that the Placoderms in this larger sense are true fishes, and that among them the Coccosteids occupy an ancestral position, on the one hand to the ancient Ganoids and to the Chimæroids; on the other hand, they show relationships to the Stegocephalia and Amphibia.

These views differ very widely from those recently presented afresh by Patten in the *American Naturalist,* who regards the Ostracoderms, especially as seen in the *Trematapis* form, as intermediate between crustacea somewhat of *Limulus* type and vertebrates.

ORIGIN OF THE TURTLES.

Still more important is Dr. Jaekel's description of a new Placodont* from the Upper Triassic, which he names *Placochelys placodonta,* owing to the fact that he believes it constitutes a toothed ancestor or collateral of the turtles. Since *Placodus* and the related form of *Cyamodus* have hitherto been placed by Zittel and others near the Anomodont reptiles, the discovery of an animal which unites the skull of the *Placodus* type with the armored skeleton of the Chelonian type is most interesting. Dollo had already predicted the existence of toothed turtles, and the present reviewer was strongly of the opinion that *Placodus* belonged much nearer the turtles than the Anomodonts. This new animal, *Placochelys,* suggests to the author the ancient Rhynchocephalian *Hyperoadapedon.* The structure of the skull and other parts of the skeleton is not at all like that of the Anomodonts; on the other hand, it is more similar to that of primitive Plesiosaurs such as *Nothosaurus* and *Pistosaurus.* This would confirm Baur's opinion of the strong original relations between Plesiosaurs and Chelonia. The carpus, as well as the skull structure and spread of the ribs, points to resemblances especially to Chelonia of the order Pleurodira.

* 'Ueber Placochelys n. g. und ihre Bedeutung für die Stammesgeschichte der Schildkröten,' Sep.-Abd. a. d. *Neuen Jahrb. f. Min., Geol. u. Pal.,* 1902, Bd. I.

ABANDONMENT OF THE OLIGOCENE AND MIOCENE LAKE BASIN THEORY.

Hatcher's recent discussion* of the origin of the Oligocene and Miocene deposits of the great plains, following the argument strongly presented by Dr. W. D. Matthew in his memoir 'Fossil Mammals of Northeastern Colorado,' appears to give the death blow to the lake basin theory of most of the great deposits east of the Rocky Mountains. The earlier writers, including David Dale Owen, King, Hayden, Leidy, Cope, Marsh and others, were always accustomed to speak of these deposits as lacustrine, and they are at present, or were until very recently, so considered by many authorities, such as Todd, Scott, Dalton. While the Lower Oligocene or White River series are largely composed of river and flood-plain deposits, Mr. Hatcher shows the absence of any evidence of the existence of a great lake. He adds to the observations of Matthew numerous geological and faunal observations of his own, such as the occurrence of shallow water forms of plants and animals, characteristic of small springs, shallow ponds and brooks, remains of forests, and the absence of remains of crocodiles, turtles and fresh-water fishes. He concludes: "The above facts, together with those brought forward by Dr. Matthew, have driven me, contrary to my earlier opinion, to reject the theory of a great lake and accept that of small lakes, flood-plains, river channels and higher grass-covered pampas as the conditions prevailing over this region in Oligocene and Miocene times."

STUDIES OF EOCENE MAMMALIA IN THE MARSH COLLECTION, PEABODY MUSEUM.

The first part of these very interesting and important studies by Dr. J. L. Wortman† have now been published in collected form, making a bulletin of 144 pages, abundantly illustrated with pen drawings, including the description

* 'Origin of the Oligocene and Miocene Deposits of the Great Plains.' *Proc. Am. Phil. Soc.,* xli., Apr., 1902, p. 113.

† 'Studies of Eocene Mammalia in the Marsh Collection, Peabody Museum, Part I., Carnivora,' *Amer. Jour. of Science,* Vols. XI.–XIV., 1901–1902.

of a large number of new species as well as full and accurate definitions of the species proposed by Professor Marsh, and setting forth a number of original views regarding the relationship of these animals. As regards the larger relationships of the earliest American Carnivora or Creodonts, Wortman believes that they sprang from Metatheria or primitive Marsupials in Huxley's sense, rather than that the Marsupials and primitive Placentals sprang alike from a common marsupio-placental stock, as defined by Osborn. Among the Mesonychidæ especially are found numerous illustrations of the Marsupial relationship, such as evidence of the extreme helplessness of the young at the time of birth. The dogs are clearly carried back into the Eocene, and it is shown that they split up into several series, one type leading to the *Amphicyon* series of Europe and America. A new genus *Oödectes,* is proposed; and the position is taken that the descent of the modern Viverrines is probably traceable to these Eocene types. Similarly the Felidæ, or cats, are provisionally traced back to *Ælurotherium.*

The author rejects the homologies of the dental cusps established by Osborn on Cope's tritubercular theory, concluding as follows: 'The manner of origin of these cusps having been incorrectly determined, it follows that the homologies are wrong, and the names applied inappropriate and misleading.' Even if this statement were supported by subsequent discovery, it would not justify the further conclusion of the author that the names of the cusps 'should, therefore, be abandoned, since they can be productive only of confusion and error in any attempt at further progress in the subjects' (p. 98). Similarly the author rejects Osborn's views regarding the value of the articular facets in determining the position of the feet in the early clawed animals, concluding that the 'planes of the articular facets, as applied to the feet of the Carnivora, have *little or no value* in determining whether a given animal is plantigrade or digitigrade.'

Altogether this paper is of exceptional value, and the authorities of the Yale Museum are to be congratulated upon its publication. It does full justice to the early observations of Professor Marsh, which for lack of time were never amplified. Attention may again be directed to the extreme importance of inserting museum catalogue numbers of the fossils in connection with all figures and descriptions, especially because this purports to be a more or less final revision of the material.

A NEW PLEISTOCENE RHINOCEROS RELATED TO THE SUMATRAN FORM.

DR. FRANZ TOULA, of Vienna, gives a very full description* of a new species of rhinoceros (*R. hundsheimensis*) found in Austria in 1900, and very closely related to the Sumatran rhinoceroses. Unfortunately the diagnostic anterior portion of the nasal bones is wanting. An especially valuable feature of the memoir is a comparison of a very large series of skulls of the Sumatran rhinoceros, showing the extreme variability in the shape of the anterior horn and in the development of its bony supports; also the variations of the occiput, and of the teeth. The author concludes that this species undoubtedly belongs in the series (subfamily Ceratorhinæ Osborn) including *R. etruscus, R. megarhinus* and *R. schleiermacheri.* These rhinoceroses are characterized by long skulls, somewhat elongate limbs, and a pair of widely separated horns on the nasals and frontals. This is further confirmation of the polyphyletic character of the Perissodactyles in general.

RELATIONS OF OKAPIA.

DR. E. RAY LANKESTER has recently completed his memoir† on *Okapia,* giving the history of the discovery, an account of the region it occupies, a complete description of the skull and jaws and of the characters presented by the skin and notes on the nature and origin of horns in the Pecora. The memoir is illustrated by three beautiful plates. He concludes that the genus may be characterized as a member of the Giraffidæ,

* 'Das Nashorn von Hundsheim,' *Abd. d. K. K. Geol. Reichs,* Bd. XIX., Heft 1, Vienna, April, 1902.

† 'On *Okapia,* a new Genus of Giraffidæ, from Central Africa,' *Trans. Zool. Soc. of London,* Vol. XVI., Pt. VI., August, 1902.

but contrasted with (*a*) *Giraffa*, by its pair of supraorbital or frontal horn-bosses, which in *Giraffa* are parietal instead of frontal, and with (*b*) *Helladotherium*, in which there are no paired horn-bosses. It is closely related to *Samotherium*, especially in the presence of these suprafrontal ossicusps (conical bony horns). Dr. Forsyth Major, of the British Museum, is making an examination of these rudimentary or possibly vestigial horns in regard to their bearing on the whole question of the origin of horns. H. F. O.

FIELD WORK IN VERTEBRATE PALEONTOLOGY AT THE CARNEGIE MUSEUM FOR 1902.

Through the continued generosity of Mr. Carnegie, the founder of this institution, the Department of Vertebrate Paleontology has been enabled to continue the work of exploration in the fossil fields of the West, which was undertaken some three years ago and the prosecution of which has been attended throughout with almost phenomenal success.

Early in the season the present writer, under whose direction the work has been carried on, planned and organized four parties for exploration. One of these, under Mr. O. A. Peterson, was sent first into the White River Tertiaries of Sioux County, Neb., and later into the adjacent Laramie deposits of Converse County, Wy. In the White River beds the party under Mr. Peterson secured, among other material, five Titanothere skulls, a considerable portion of the skeleton of Elotherium, and material which it is thought will be sufficient to mount the skeletons of Hyracodon and Hoplophoneus. In the Laramie portions of the skulls and skeletons of both *Triceratops* and *Dryptosaurus* were secured.

Mr. C. W. Gilmore was returned to southern Wyoming to continue the work commenced in that region in the season of 1899 by Dr. J. L. Wortman, and since carried on with such splendid results by Mr. O. A. Peterson in 1900 and Mr. Gilmore in 1901. The bone quarries on Sheep Creek were worked until about the middle of the season, when they were abandoned and a new quarry opened up in the Freeze Out Mountains. From this, valuable collections, especially of the remains of Morosaurus and some of the carnivorous forms of Jurassic Dinosaurs, were recovered.

Mr. W. H. Utterback was sent to explore the Mesozoic deposits about the slopes of the Big Horn Mountains in Wyoming. He was successful in discovering, in the Jurassic deposits on Powder River, the skeleton of a Sauropod dinosaur in which the bones are in an excellent state of preservation and which, moreover, gives promise of being the most perfect skeleton of any member of the Sauropoda yet discovered.

Mr. Earl Douglass undertook an exploration of the various Tertiary horizons and localities recently discovered by him in Montana and reports most gratifying results, having secured more than fifty skulls of Tertiary mammals, many of them associated with considerable portions of the skeleton. Mr. Douglass was also fortunate in discovering in one locality, in beds belonging to the White River formation, a horizon where fossil fishes were both abundant and well preserved.

J. B. Hatcher,
Curator of Vertebrate Paleontology, Carnegie Museum.

INAUGURATION OF CHANCELLOR FRANK STRONG AT THE UNIVERSITY OF KANSAS.

For the Inauguration Exercises of the new Chancellor at the University of Kansas, three days, October 16, 17 and 18, were set apart. This was a notable event in the history of education in the middle west. On Thursday, October 16, occurred the dedication of the chemistry building, recently completed. The dedicatory exercises were under the auspices of the Kansas City Section of the American Chemical Society. The following papers were read and discussed: 'The New Reaction of the Formamidines,' by Professor F. B. Dains of Washburn College, and 'Ionic Velocities in Liquid Ammonia,' by Professor E. C. Franklin, of the University. In the evening a large audience assembled to listen to the formal dedicatory address by Dr. Harvey W. Wiley, Chief of the Bureau of Chemistry, De-

partment of Agriculture, his subject being 'The Rôle of Chemistry in University Education.'

On Friday the inauguration exercises proper took place in the hall of the Natural History Museum which is nearly completed. There were distinguished visitors, faculty, students and alumni, to the number of over 1500 in the procession. The inauguration exercises consisted of an address on behalf of the state by Gov. Wm. E. Stanley; an address which was largely reminiscent by Ex-Chancellor F. H. Snow; an address on 'The Purposes of the American University,' by President Arthur T. Hadley, of Yale University. Hon. Scott Hopkins, a member of the Board of Regents, formally handed over the University to the new Chancellor, Dr. Frank Strong, who made the Inaugural Address on 'The Relation of Educational Development to the Problems before the University of Kansas.' He was followed by Professor W. H. Carruth on behalf of the Faculty of the University; Chas. L. Faust, of the Law School, on behalf of the students; A. C. Scott, President of the Oklahoma Agricultural and Mechanical College, for the alumni; L. D. Whittemore, of the Topeka High School, for the Kansas High Schools; Dr. L. H. Murlin, of Baker University, for the Colleges of Kansas. An audience of nearly 3000 was present at these exercises. In the evening, the same auditorium, which had been elaborately decorated by different classes and organizations of the university and brilliantly lighted with electric lights, was used for the inauguration luncheon, for which over 1100 covers were provided. With Chancellor Strong in the capacity of toast-master, the audience listened to short after-dinner speeches, by Dean L. B. Briggs, of Harvard University; President Benj. I. Wheeler, of the University of California; President W. F. Slocum, of Colorado College; President R. H. Jesse, of the University of Missouri; Hon. W. Y. Morgan, State Printer of Kansas; Professor C. E. Turner, representing the University of Wisconsin; Dean A. F. Burton, representing the Massachusetts Institute of Technology; Hon. Gardner Lathrop, of Kansas City; Rev. W. J. Dalton, of Kansas City; Professor Albion W. Small, representing the University of Chicago; Professor Chas. DeGarmo, representing Cornell University; Dr. C. E. Bessey, of the University of Nebraska; Dean David Kinley, of the University of Illinois; President P. B. Nichols, of Colorado Agricultural College; Chancellor W. S. Chaplin, representing Washington University, St. Louis; Professor H. W. Richmond, of Wm. Jewell College, Missouri; Hon. Frank Nelson, State Superintendent of Public Instruction; President D. R. Boyd, University of Oklahoma; President Nichols, of the University of Colorado; Professor J. N. Wilkinson, of Kansas State Normal School; Professors F. W. Blackmar, E. Haworth and A. M. Wilcox, of the University of Kansas; Ewing Herbert, of Hiawatha; and Dr. Harvey W. Wiley of Washington, D. C.

Saturday was devoted to athletic sports, consisting of tennis tournaments by representatives of Nebraska, Missouri and Kansas Universities, a golf tournament on the Oread Links; a hare-and-hounds run by the students of Haskell Institute and the University; and finally a foot-ball game on McCook Field. The exercises of this installation mark an epoch in the history of this University, which began its work in 1866 with one building, and now has ten. It also has a faculty of 80 members, and more than 1200 students in attendance, and instruction is given in the Schools of Arts, Engineering, Law, Fine Arts, Pharmacy, Medicine and in the Graduate School.

E. H. S. BAILEY.

THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE next meeting of the Association will be held in Dunedin, New Zealand, in January, 1904. Dr. L. O. Howard, permanent secretary of the American Association, has received a letter from Mr. George M. Thomson, honorary secretary of the Australasian Association, which reads as follows:

> The next meeting of the Australasian Association is to be held in Dunedin in January, 1904, and on behalf of the Local Council I have much pleasure in extending to members of your Association who may be able to afford the time necessary for such a trip a cordial invitation to attend

it. With the cooperation of the Government of the Colony it is hoped that special facilities will be extended to accredited members of your Association to enable them to see these southern islands.

The present is merely a preliminary notice to bring the matter under the observation of your members. I hope next year to extend a more formal invitation and to be able to state more definitely what provision is being made for the entertainment of visitors.

The presidents of the sections of the meeting are

B.—Chemistry: J. Brownlie Henderson, Government analyst, Brisbane.

C.—Geology and mineralogy: W. H. Twelvetrees, F.G.S., Hobart.

D.—Biology: Colonel W. V. Legge, R.A., Hobart.

E.—Geography: Professor J. W. Gregory, Melbourne University.

F.—Anthropology and philology: A. W. Howitt, F.G.S., Melbourne.

G.—Economics, sub-section 2: Agriculture—J. D. Towar, principal Roseworthy Agricultural College, South Australia.

H.—Architecture, Engineering, and Mining: H. Deane, M.A., M.I.C.E., engineer-in-chief Public Works Department, Sydney.

I.—Sanitary, science, and hygiene.—Dr. Frank Tidswell, Department of Public Health, Sydney.

J.—Mental science and education: John Shirley, B.Sc., inspector of schools, Brisbane.

SCIENTIFIC NOTES AND NEWS.

The National Academy of Sciences holds its autumn meeting at the Johns Hopkins University, Baltimore, beginning on Tuesday, November 11.

Professor Kohlrausch, president of the Reichsanstalt, has been elected a foreign member of the Swedish Academy of Sciences.

Dr. Wilhelm Forster, director of the Royal Observatory at Berlin, has announced his intention of retiring a year hence. He will, however, retain his professorship in the University of Berlin.

A committee of prominent physicians of Philadelphia and Baltimore have arranged for a complimentary dinner to Drs. W. W. Keen and H. C. Wood in honor of their recent return from their long sojourn abroad. The dinner will be given at the Bellevue Hotel, Philadelphia, November 6.

A dinner in honor of the eightieth birthday of Mr. John Fritz, the eminent steel master, and to commemorate the medal established in his honor, was held in New York City on October 31 under the auspices of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. In the presence of about 400 engineers and others interested in the manufacture of iron and steel the following program of speeches, with one by Mr. Fritz, was presented:

Salutatory, Henry Goslee Prout, C.E., M.A., Toastmaster.

Presentation of the Medal, John Thomson, C.E.

'The Fathers of the Art,' Hon. Abram S. Hewitt, LL.D.

'The Navy,' Rear-Admiral George W. Melville, U. S. N.

'The Army,' Brig.-Gen. Eugene Griffin, U. S. V.

Messages of Congratulation, Chairman Dinner Committee.

'The American Society of Civil Engineers,' George Shattuck Morison, C.E., M.A.

'The American Institute of Mining Engineers,' Dr. Rossiter W. Raymond, E.M.

'The American Society of Mechanical Engineers,' Capt. Robert W. Hunt, C.E., M.E.

'The American Institute of Electrical Engineers,' Professor Elihu Thomson, E.E.

'The Valley and the Neighbors,' Oliver Williams.

'John Fritz' Old Boys,' Daniel A. Thompkins, M.E.

Professor Hans Virchow, son of the late Rudolf Virchow and professor of anatomy in the University of Berlin, has celebrated his fiftieth birthday.

Dr. K. Gayer, professor at Munich and known for his contributions to forestry, has celebrated his eightieth birthday.

MM. Lippmann and Radeau have been appointed members of the council of the Observatory of Paris, filling the places vacant by the deaths of MM. Cornu and Faye. M. Bayet has also been appointed a member of the council of the Observatory of Paris and a member of the council of the Astrophysical Observa-

tory of Meudon in place of M. Liard, recently made vice-rector of the University of Paris.

THE Swedish explorer, Sven Hedin, has begun a tour of the principal cities of Germany to lecture on his travels in Central Asia.

MISS ELIZA R. SCIDMORE, foreign secretary of the National Geographic Society, is a delegate from the Society to the Thirteenth International Oriental Congress meeting in Hamburg.

AT a meeting of the Cold Storage and Ice Association, held at the Institution of Mechanical Engineers on November 5, Dr. Carl Linde, of Munich, read a paper on 'The Technical Application of Liquid Air.'

THE Mayor of Ealing has unveiled a memorial, which has been erected by public subscription, in the Ealing Public Library to the late Professor Huxley, who was born at Ealing on May 4, 1825. The memorial consists of a mural tablet with a portrait medallion of Huxley by Mr. Frank Boucher. Among those present were Mrs. Huxley, widow of the distinguished scientist, Mr. and Mrs. Leonard Huxley, Professor George Henslow (who presided), and representatives of several of the learned societies with which Huxley was associated.

AN effort is being made by the mayor and municipal council of St.-Just-en-Chaussée, Oise, France, to raise a memorial to two famous men who were born in that town, the brothers Haüy-René Just, founder of mineralogy as an exact science, and Valentin, the philanthropist, who founded the first school for the blind. A sum of 7000 francs has already been raised, mostly in the locality; 25,000 francs is the sum required to carry out the project. American subscriptions may be sent to M. Léon Bourgeois, 1 boulevard Henri IV., Paris.

MAJOR JAMES C. MERRILL, surgeon, U. S. A., librarian of the Army Medical Museum, and known for his contributions to ornithology, has died at the age of forty-nine years.

MR. PETER BROTHERHOOD, a British mechanical engineer, the inventor of an important steam motor, has died in his sixty-fifth year.

DR. HERMANN EULENBERG, an eminent German psychiatrist, has died in Bonn at the age of eighty-nine years.

THE mathematician, Professor Nikolaus Budajew, of St. Petersburg, has died at the age of sixty-nine years.

THE visiting Society of Americanists passed through Washington on Tuesday, October 21, spending the entire day there. In the morning they were received by the President, after which they were driven to various places of interest, scientific and otherwise, ending at the Congressional Library, where lunch was served. In the afternoon they were received at the Smithsonian Institution by Secretary Langley and spent most of the remainder of their time there and at the National Museum. Smaller parties visited other points of scientific interest, but all met at the Arlington Hotel for dinner at 5:30. This was presided over by Professor C. D. Walcott, who introduced Professor W J McGee as toastmaster, and short speeches were made by the vice-presidents of the society. At 7:30 the visitors left for Pittsburg and Chicago.

THE eleventh International Congress of Hygiene and Demography will be held at Brussels from September 2 to September 8, 1903. The office of the secretary-general of the Congress is 1 Rue Forgeur, Liége.

THE Belgian Surgical Society, which recently held a meeting in Brussels, has appointed a committee, consisting of prominent surgeons from all parts of the world, to draw up plans for the foundation of an international surgical society.

THE International Congress of Tuberculosis adjourned on October 26 to meet next year at Paris.

THE state and provincial boards of health at their meeting at New Haven on October 29 passed the following resolution: "That the conference of State and Provincial Boards of Health of North America views with abhorrence the irretrievable disgrace of the present State Board of Health of California, and pronounces the plague situation in California a matter of grave national concern. That the National Conference of State

and Provincial Boards of Health of North America does hereby advise the various State Boards of Health of the United States to consider the propriety of calling upon the Surgeon General of the United States Public Health and Marine Hospital Service to arrange at the earliest possible date a joint conference for the purpose of eradicating the plague from the United States.

It is stated in *Nature* that the office of Meteorological Reporter to the Government of India will become vacant in about a year by the retirement of Mr. J. Eliot, F.R.S., who has administered the office with great success for a long series of years. The selection of suitable names for consideration, with a view to the filling of the prospective vacancy after a preliminary period of training in Europe and in India, is now occupying the attention of an advisory committee of the Royal Society, nominated at the request of the government of India. The problem of the future administration and scientific development of the department is also under consideration by the committee, in conjunction with Mr. Eliot, who is now in England for that purpose.

The British Museum of Natural History has recently acquired a valuable collection of birds and animals secured by an expedition to the north and northwest of Ethopia.

The federated Malay states have opened a pathological laboratory for the study of tropical diseases at Kuala Lumpur. It is open to students of all nations.

Dr. Cyrus W. Thomas, of the Bureau of Ethnology, announces the discovery that that part of Lederer's account which deals with explorations in Carolina in 1670 is an invention and that his map of the country between 'Akenatzy' and the head waters of the Neuse is practically worthless.

The copies of Part I. of the Nineteenth Annual Report of the Bureau of Ethnology have been received at the latter institution from the Government Printing Office.

The Scottish Antarctic expedition in the *Scotia* under the leadership of Mr. W. B. Bruce has sailed, its first destination being the Falkland Islands. Before sailing Mr. Bruce and the principal members of the expedition were entertained to dinner in Edinburgh by the president of the Royal Scottish Geographical Society, Sir John Murray. According to the account in the London *Times* the president, in proposing success to the expedition, said that when Mr. Bruce came to him with his first proposal of an Antarctic expedition it was one which was to consist of two ships, and was to extend to two winters in the Antarctic, and was to cost £35,000. Mr. Bruce had not succeeded in raising £30,000, and he had found it necessary to limit his expedition to one ship and to about one year's cruise. The men in a day or two would start through the fiery zone of the tropics to the frigid zone of the Far South, there to do battle with the fiercest forces of nature and to fight with the most forbidding region that our planet afforded. He hoped they would come out of that struggle victorious. Mr. Bruce, replying, said that there had been a good deal of misconception about the purpose of the Scottish National Expedition. There had been an idea in some quarters that they were starting it as a rival to the others in the field. The idea was not that it should be a rival, but a supplementary expedition. There were three expeditions working in the Antarctic, one sent out largely with the assistance of the British Government, one German, and the other Swedish. They were all more or less associated with the land. The Scottish expedition was especially associated with the sea. The Scottish expedition concentrated on the oceanographical side. Their region would be that part of the Antarctic where Sir James Ross, 60 years ago, took one sounding, attaining a depth of 4,000 fathoms, and reaching no bottom. Captain Robertson, master of the *Scotia,* also replied.

Park Commissioner William R. Willcox, on October 31, formally turned over to the New York Zoological Society the Aquarium in Battery Park. The legal transfer was accomplished several days ago. Professor H. F. Osborn, chairman of the executive committee and vice-president of the Zoological Society, received the city's gift. Commissioner Willcox in mak-

ing the transfer, told how the building had been erected originally upon the rocks and connected with the shore by bridge, and how the structure had been used successively as a battery, a place of amusement, and a landing place for immigrants, until finally in 1896 it was opened to the public as an aquarium by the Department of Parks. Charles H. Townsend, recently appointed director of the Aquarium, and formerly a member of the United States Fish Commission, said in part: "The possibilities of an aquarium as an institution for the instruction of the people have never been properly understood. What we want to do is to make it a part of the city's educational system. It should be a place for study and investigation. Fish culture is fast becoming a profession. We could establish a fish hatchery in the building. This would be interesting, and it could be arranged with glass sides so that the fish could be seen." Professor Osborn said it would be the aim of the Zoological Society to make the Aquarium even more popular than it had been, and added: "We have chosen as director Mr. Charles H. Townsend, widely known for his services in the United States Fish Commission, and the fact that a man of his character and scientific reputation accepts this position signalizes our determination to increase not only the attractiveness, but the educational value of the Aquarium to the masses of the people who visit it. Mr. Townsend will have full authority here; but we are fortunate in associating with him as an advisory board three experts in marine life—Professor Charles L. Bristol, of the New York University, Dr. Alfred G. Mayer, of the Brooklyn Institute of Arts and Sciences, and Professor Bashford Dean, of Columbia University.

The British Medical Journal states that the Huxley memorial lecture of the Anthropological Institute of Great Britain and Ireland was delivered in the lecture theater of the building formerly occupied by the University of London in Burlington Gardens by Dr. D. J. Cunningham, F.R.S., professor of anatomy in Trinity College, Dublin, who selected the subject of right-handedness and left-brainedness. He pointed out that the characteristic was one of vast antiquity, and argued that it had been attained in the ordinary course of the evolution of man by natural selection; but the condition thus established and transmitted from one individual to another did not reside in the right upper limb itself or in the vessel which conveyed the blood to it. All the evidence went to show that right-handedness was due to a transmitted functional preeminence of the left brain. This preeminence was not a haphazard acquisition picked up during the life of the individual, it was not the result, but through evolution it had become the cause, of right-handedness. The superiority of the left cerebral hemisphere rested upon some structural foundation transmitted from parent to offspring, and the exceptional cases of right-brainedness and left-handedness were due to the transference of this structural peculiarity from the left to the right side, or more probably to a transposition of the two cerebral hemispheres in the same way that transposition either partial or complete of the thoracic and abdominal viscera sometimes occurred. At the conclusion of the address the Huxley memorial medal was presented to Professor Cunningham by the president, Dr. A. C. Haddon.

The Electrical World states that during the passage of the special train on the Grand Trunk Railway, between Toronto and Montreal, on October 13, bearing the members of the American Association of General Managers and ticket agents from Chicago to Portland, wireless telegraphic signals were received by the party as the train passed St. Dominique station, at the rate of sixty miles an hour. No special attempt was made to signal to a great distance, but the train remained in touch with the station for from eight to ten miles. Two vibrators, ten by twelve feet, connected with an induction coil of the usual pattern (eight-inch spark), served to transmit the waves from the station, while on the train itself the waves were received by a coherer of the ordinary type. A relay rendered the signals audible to the passengers by ringing bells in three cars. The collecting wires

were run through the guides for the signal cord inside of the train, and extended about one-car length on either side of the coherer. Owing to the natural vibration of the train it was impossible to have the relay at the most sensitive point, but the distance to which it was possible to keep the train in touch with the station was considered very satisfactory by the various officials. The apparatus was loaned for the experiments by the physical department of McGill University, Professor E. Rutherford and Professor H. T. Barnes, assisted by Mr. H. L. Cooke, being present to look after the adjustments. Dean Bovey and Professor C. H. McLeod, of the engineering department of McGill, also witnessed the experiments.

The department of revenue and agriculture of the government of India has recently published the seventeenth issue of 'Agricultural Statistics of India for the years 1896–97 to 1900–01.' According to an abstract in *Nature* the numerical data have been compiled under the supervision of the director-general of statistics and are issued in two parts, the first dealing with British India and the second with native states. The information is tabulated under fourteen headings, including, among others, tables showing the total area of districts; the amount of cultivated and culturable land; the gross cultivated area under each crop; agricultural stock; the principal varieties of tenure held direct from the government; the progress made in the production of tea and of coffee; and the average yield per acre of the principal crops. The tables are accompanied by numerous short, explanatory notes which are often of an interesting nature. The following statistics referring to the cultivation and production of indigo in British India during the past few years show that a remarkable decline has occurred, doubtless in consequence of the competition of the artificial product:

Year.	Acres under Cultivation.	Production in Cwts.
1897–1898	1,339,099	166,812
1898–1899	1,010,318	139,320
1899–1900	1,026,900	111,890
1900–1901	990,375	148,029
1901–1902	803,697	121,475

The U. S. Geological Survey has recently made public the results of a series of measurements which the division of hydrography conducted in 1901 on a large number of streams in the United States to determine the volume of their flow. The work with which these records deal is unique in character and extent, and consists in the daily record of the height of water, together with the estimated maximum, minimum and average monthly flow in cubic feet, in upwards of two hundred and fifty of the important rivers of the United States. Accompanying these data are important facts concerning the physical aspects of their watersheds, the extent and manner to which their natural powers are utilized, and other information of value to engineers and water users. The report of the investigation of the New York streams is particularly full, an interesting feature being the results of measurements on streams in the Catskill and adjacent regions suggested as a possible source for the supply of New York city. Of interest also are the results of measurements of the streams in the west upon which depend the construction of the contemplated irrigation works under the new irrigation law. The water-power streams of Maine, the drainage from the vast watershed of the southern Appalachians, and the rivers of the central states are all represented in the investigation.

The thirteenth annual general meeting of the Mining Institute of Great Britain was opened on September 16, in Newcastle-on-Tyne, and simultaneously with it was held the jubilee meeting of the North of England Institution of Mining and Mechanical Engineering, upon whose foundation the Mining Institute was built up. Sir Lindsay Wood presided and in his address, according to the report in the *London Times*, reviewed the past history of the institute, and showed that the objects of the founders had been carried out and that the results they anticipated had been realized. He called attention to the great loss of life which occurred in the working of the coal mines of Great Britain previous to 1851, and said it was a universal desire to stop or reduce

to a *minimum* this loss of life that in 1835 a committee of the House of Commons was appointed to inquire into the cause of the accidents that were taking place. That committee reported, with regret, that the result of their inquiry had not enabled them to lay before the House any particular plan by which the accidents might be avoided with certainty, and consequently they made no decisive recommendation. In spite of subsequent committees and investigations, both official and private, the loss of life from accidents in mines did not decrease, and it was under these circumstances that a meeting of mining engineers and gentlemen connected with the working of the mines in the North of England was held at Newcastle on July 3, 1852, for the purpose of forming a society to meet at fixed periods and discuss the means of ventilation of coal mines with a view to the prevention of accidents and for general purposes connected with the mining and working of collieries. The society so formed was the beginning of the Mining Institute. He held that by an interchange of practical experience and by a united and combined effort to improve themselves in the science of their profession they had raised the art and science of mining engineering to a higher state of efficiency than it was in 50 years ago. The good work of the institute was recognized by the government in 1876, when it was granted a royal charter. Similar institutions were formed in various mining districts of the country, and in 1889 these were federated under the title of the Institute of Mining Engineers. He referred to the great part taken by the institute in the formation of the Durham University College of Science in 1871, and said there had been an enormous reduction in the number of fatalities in mines in consequence of the proceedings of the institute and to the education of its members. During the last 50 years the coal trade of the country had greatly increased, the output having more than quadrupled in the period. From 1851 to 1855 the number of deaths caused by explosions in mines averaged 231 per annum, whereas the average of the last five years was 64; if the difference in the number of men employed was taken into consideration, the deaths, calculated at the same rate as in the earlier period, would have been 765. The number of fatal accidents from the falls or roof and sides and from accidents in and about the shafts had also greatly decreased. The total loss of life from all sources on the average of the five years from 1851 to 1855 was 985 per annum, whereas the average of the five years from 1896 to 1900 was 1,001 per annum, or 16 more than in the first period, although there were 525,297 more men and boys employed in and about the mines. If the earlier death-rate had continued during the latter period there would have been a loss of 3,146 lives. There was still much to be accomplished, however, particularly in the reduction of the number of accidents due to falls of roof and sides in mines.

IN a recent paper published by the U. S. Geological Survey, on Wells and Windmills in Nebraska, mention is made of the phenomena of the breathing or blowing wells which are found distributed throughout a large portion of the State of Nebraska. These wells are of the driven type mostly in use upon the Plains, but are distinguished from those of ordinary character by a remarkable and unexplained egress and ingress of currents of air which produce distinctly audible sounds and give the names variously applied to them of breathing, sighing, blowing, or roaring wells, according to their characters in different places. The air currents are readily tested with the flames of candles, or by dropping chaff or feathers into the well tubes. There are periods when these wells blow out for several days, and equal periods when their air currents are reversed. It has been observed that the blowing occurs with changes of the barometer. Some wells are found to be most audible when the wind is from the northwest, with a rise in water level; but with a change of wind air is drawn in and the water is observed to sink. During the progress of a low-barometer area over one of these regions, wind is violently expelled from the wells, with a noise distinctly audible for several rods. Professors Loveland and Swezey, of the University

of Nebraska, have made observations on a well of this nature in Perkins County, and found that its breathing periods were exactly coincident with the barometric changes. The material through which the wells are driven may throw some light on their peculiarities. In southeastern Nebraska a layer of dense limestone about four inches thick lies beneath 50 to 100 feet of subsoil. Below the limestones is found water-bearing gravel. When the limestone covering the water-bearing beds is penetrated water under slight pressure rises about one foot. The water-bearing layer is very porous and must always contain more or less air. As the air above and the air inclosed in the gravels below are alike subject to the fluctuations of the barometer, it follows that if the surface air is rendered less dense the air below will pass out through the well openings until equilibrium between the rarer air and denser air is established, and the opposite effect will follow during a period of high pressure. Still, this explanation, plausible as it is, hardly accounts for the force with which the air is expelled from some of the wells, and a more comprehensive study of the problem is needed to satisfactorily explain all the phenomena.

UNIVERSITY AND EDUCATIONAL NEWS.

It appears that Clark University will receive the sum of $1,577,000 from the estate of the late Jonas G. Clark. This we understand is in addition to the $500,000 already paid on account of the collegiate department.

At a recent meeting of the board of trustees of Cornell University plans were authorized for the purchase of sixteen additional acres of land and for the erection of new buildings. A site was assigned for the Hall of Physics, for which Mr. John D. Rockefeller gave $250,000, and for a Hall of Arts and Humanities, to cost $250,000. A plan for retiring and pensioning professors was discussed.

The trustees of the College of the City of New York have authorized the adoption of the architect's plans for the new buildings to be erected at a cost of $2,100,000.

Sir William MacDonald has given the department of physics of McGill University an installation for making liquid air.

A development of the equipment of the University of California's College of Medicine, to consist of a clinical hospital that will cost $400,000, has been proposed in a report submitted by a committee.

The daily papers state that M. Michonis, a French millionaire, has bequeathed $120,000 as a fund to enable French students to study philosophy and religious sciences in German universities.

Dr. T. H. Starkey, of University College Hospital, London, England, has been recommended by the Dean of the medical faculty as professor of hygiene at McGill University, in succession to the late Dr. Wyatt Johnston.

At Prague Dr. F. Vejdovsky, professor of embryology and comparative anatomy, has been appointed professor of zoology, replacing Dr. Anton Fric, recently retired.

The sixteenth annual meeting of the Association of Colleges and Preparatory Schools in the Middle States and Maryland will be held in Baltimore on November 28 and 29 next. Among the subjects to be discussed are 'The Educational Value of Examinations as the Culmination of Preparatory Courses' and 'The Relative Functions and Powers of President, Trustees and Faculty.' On the latter subject President Ira Remsen, of the Johns Hopkins University, will speak on the college presidency; Dr. S. J. McPherson, a trustee of Princeton University, will speak on the duties of the trustee, and Professor George S. Fullerton, of the University of Pennsylvania, will explain the position of the faculty.

Mr. E. D. Bell, M.S., has been elected to the chair of animal biology in the Utah Agricultural College, Logan, Utah.

Professor Wladislaw Rothert, of Charkow, has been elected professor of botany in the University of Odessa.